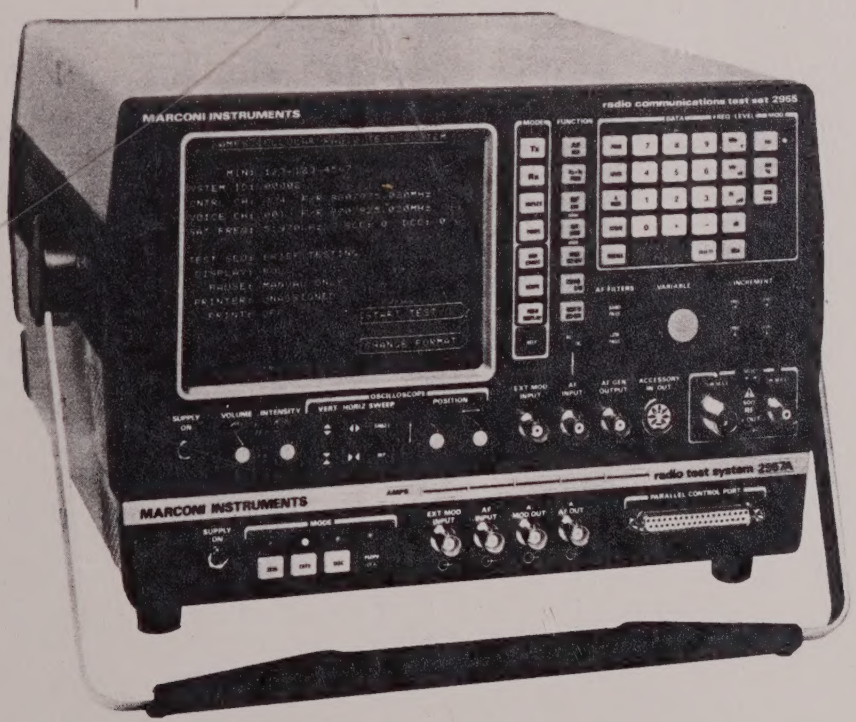
Marconi
Instruments

2957A

RADIO TEST SYSTEM for AMPS



Service Manual

Service Manual

H 52957-901B
Vol. 2

RADIO TEST SYSTEM

2957A

(for AMPS)

Part no. 52957-901B

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PREFACE

The Radio Test System 2957A consists of a Radio Communications Test Set 2955 with a Cellular Adapter. The Cellular Adapter includes software for AMPS.

This manual contains some details of circuits which are not relevant to AMPS.

AMENDMENT STATUS

Each page bears the date of the original issue or the date and number of the latest amendment. Any changes subsequent to the latest amendment are included on Manual Change sheets coded C1, C2 etc.

HAZARD SYMBOLS

The following symbols appear on this equipment.

Symbol	Type of hazard	Reference in Manual
	Dangerous voltages	Page v
	Lithium battery	Page vi
	Cathode ray tube	Page vi
or	Static-sensitive components	Page vi
	Input overload	Page vi

WARNINGS, CAUTIONS AND NOTES

The following terms have specific meanings in this Manual.

WARNINGS contain information to prevent personal injury.

CAUTIONS contain information to prevent damage to the equipment.

Notes contain important general information.

INTEGRITY SEALS

If, during the warranty period of this product, an integrity seal is broken, by removing covers for example, the warranty will be invalidated.

Similarly, if a module with a broken seal is returned on an exchange basis, it will not be acceptable under the terms and conditions of the exchange service.

OPERATING PRECAUTIONS

This product has been designed and tested in accordance with IEC Publication 348 - 'Safety Requirements for Electronic Measuring Apparatus'. To keep it in a safe condition and avoid risk of injury, observe the following **WARNING** notices. To avoid damage to the equipment, observe the **CAUTION** notices.

WARNING - ELECTRICAL HAZARDS

AC supply voltage

This equipment conforms with IEC Safety Class 1, meaning that it is provided with a protective earthing lead. To maintain this protection, the mains supply lead must always be connected to the source of supply via a socket with an earthing contact. Make sure that the earth protection is not interrupted if the supply is connected through an extension lead or an autotransformer.

Before fitting a non-soldered plug to the mains lead, cut off the tinned end of the wires. Otherwise, cold-flowing of the solder could cause intermittent contact.

Do not use the equipment if it is likely that its protection has been impaired as a result of damage.

Fuses

Note that there are supply fuses in both the live and neutral wires of the supply lead. If only one of these fuses were to rupture, certain parts of the equipment could remain at supply potential.

Make sure that only fuses of the correct rating and type are used for replacement. Do not use mended fuses or short-circuited fuse holders.

To provide protection against breakdown of the supply lead, its connectors (and filter if fitted), an external supply fuse with a continuous rating not exceeding 6 A should be used in the live conductor (e.g. fitted in the supply plug).

Removal of covers

Disconnect both the AC and the DC supplies from the 2955 and/or the Adapter before removing the covers so as to avoid the risk of exposing high-voltage parts. If any internal adjustment or servicing has to be carried out with the supply on, it must only be performed by a skilled person who is aware of the hazard involved.

Note that the SUPPLY switch on the Adapter does not disconnect the DC supply.

Remember that capacitors inside the equipment, including any supply filter capacitors, may still be charged after disconnection of the supply. Those connected to high-voltage points should be discharged before carrying out work inside the equipment.

This applies particularly to the EHT circuit for the cathode ray tube which must be discharged by repeatedly shorting the final anode lead to the chassis or by using a bleed resistor. The residual charge on the CRT itself should also be removed by shorting the anode connector to the chassis.

WARNING - OTHER HAZARDS

Parts of this equipment are made from metal pressings. Therefore, it should be handled with due care to avoid the risk of cuts or scratches.

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

A Lithium battery is used in this equipment. This presents two hazards:-

(i) As lithium is a toxic substance, the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

(ii) If the battery is rapidly charged or discharged, there is a risk of explosion. Take care, therefore, to avoid short-circuiting it.

Cathode ray tube. When exposing or handling the tube, take care to prevent implosion and possible scattering of glass fragments. Handling should only be carried out by experienced personnel and the use of a safety mask and gloves is recommended. A defective tube should be disposed of in a safe manner by an authorized waste contractor.

CAUTION - STATIC-SENSITIVE COMPONENTS

This equipment contains static-sensitive components which may be damaged by handling. Refer to the Service Manual for handling precautions.

CAUTION - INPUT OVERLOAD

When testing a transmitter, an input overload is indicated by the message 'REMOVE RF INPUT' and an audible warning. Failure to respond could result in damage to the equipment.

CAUTION - TILT FACILITY

When the instrument is in the tilt position, it is inadvisable, for stability reasons, to stack other instruments on top of it.

Chapter 4-2

TECHNICAL DESCRIPTION

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MOTHERBOARD A1

1. See block diagram Fig. 4-2 and circuit diagrams Fig. 7-2 (microprocessor), Fig. 7-3 (disc and GPIB interfaces), Fig. 7-4 (serial and parallel interfaces) and Fig. 7-5 (analogue).

Microprocessor

2. CPU IC1 is an 8-bit Intel 8085A which uses a multiplexed data bus to accommodate the 16-bit address. Output lines A8 to A15 carry the high-order memory address. Input/output lines AD0 to AD7 carry the low-order memory address during the first clock cycle and then carry data during the second and third clock cycles. Line ALE (address latch enable) differentiates between data and address. When ALE is high, the contents of the data bus are treated as part of the address and latched in IC4. Lines WR (write) and RD (read) are low to enable the memory or I/O device selected by the address to be written into or read out from respectively. They also indicate that the data bus is available for a data transfer operation. IC2, IC3 and IC4 are transparent latches which provide tri-state buffering.

3. Memory and I/O have separate address spaces thereby increasing the total addressable space in the system. Line IO/M differentiates between them. During memory transfers, IO/M is low to the memory select decoders IC6a and IC6b. When I/O instructions are executed, IO/M is high enabling I/O decoders IC9 and IC10 to access up to 16 ports.

4. Crystal XL1, operating at 7.68 MHz, is connected to inputs X1 and X2. The necessary two-phase clock is produced internally. After internal division, one phase of the clock at 3.84 MHz is used to synchronize external devices.

5. Power fail detect circuit IC57 causes RESET IN to stay low until the the supply line voltages are correct before microprocessor operation commences. The program counter is then reset to a known value in order to start the program running correctly. It also causes RESET OUT to go high. RESET OUT is fed to the GPIB and disc controllers as well as to the RS-232 UART to initialize them at the same time as the program starts.

6. There are three interrupt inputs RST5.5, RST6.5 and RST7.5 in ascending order of priority. Active high interrupts RST5.5 and RST6.5 are used for interrupts from the USART on the personality board B4 when a data byte is received and transmitted respectively. The positive-edge triggered interrupt RST7.5 is used when a keyboard keypress is detected.

Interrupt controller

7. Interrupt controller IC12 manages eight interrupt requests on lines IR0 to IR7 which are passed in priority order to the CPU. At initialization, IC12 is enabled by chip select line IOS1 and, in conjunction with command select line A0, WR is asserted low to allow an initialization command to be written in from the data bus. Amongst its other functions, this command configures the interrupt priority levels so that IR0 has the highest priority and IR7 has the lowest priority. At a later stage, RD may be asserted low to read the status and then WR asserted to mask off an interrupt request line.

8. When an interrupt request occurs, the interrupt controller IC12, unless it is engaged with a higher priority interrupt, passes on the request to the INT input of IC1. On receipt, IC1 completes its current instruction and then acknowledges the interrupt request by sending a low INTA pulse. This sets buffer IC5 for data input as well as being received by the interrupt controller on the line INTA. IC12 sends a call instruction back to IC1 which responds by sending two further INTA pulses. These enable IC12 to release its pre-programmed address onto the bus in the order low byte, high byte. The address contains a pointer to the area in memory which holds the routine to service the interrupt.

Memory

9. The operating system is contained in PROMs IC7 and IC8, each of 16 Kbyte. These are enabled by IC6a which decodes lines A14 and A15 of the address bus. IC7 additionally contains the interrupt service routines.

10. IC58 is an 8 Kilobyte RAM which contains the volatile system read/write information.

Non-volatile memory

11. IC11 is also an 8 Kilobyte RAM but is non-volatile since it has battery back-up and is used to hold the status flags, user-defined sequence, etc. The RAMs are enabled by IC6b which decodes the output from IC6a and line A13 of the address bus.

12. Power for the non-volatile RAM IC11 is normally supplied from the +12 V rail though diode D3. Diode D4, which is connected to lithium battery BT1, is normally reverse-biased. When the system is switched off, or in the event of a main supply failure, D4 is no longer reverse-biased and power is supplied from the battery to maintain the memory.

13. Power fail detect IC57 protects stored data in IC11 during the application and removal of power. At power-on reset, IC57 samples the +5V and disables IC11 by keeping chip enable (CE2) low while +5V reaches its nominal value. The length of time that IC11 is disabled is determined by C4. At power off or a loss of +5V, IC57 senses a drop in +5V at and immediately disables IC11 thus protecting its stored data from spurious power-off voltages on the buses. C3 reduces the influence of fast transients on the supply voltage.

Quiet buses

14. The address bus is connected to buffer IC15. This provides a quiet address bus. The data bus is connected to buffer IC16. This provides a quiet data bus. These are used for analogue circuits to reduce noise in them.

15. Data direction for IC16 is determined by the logic state of line RD. For a read operation, this line is taken low and, for a write operation, it is taken high. The gating circuit which is formed by IC14a and IC14d controls both the latch and the buffer to ensure that I/O operation is only enabled whenever memory operation is inhibited and the interrupt controller is disabled. In this way, microprocessor activity is prevented from spilling over onto the I/O buses and causing analogue interference.

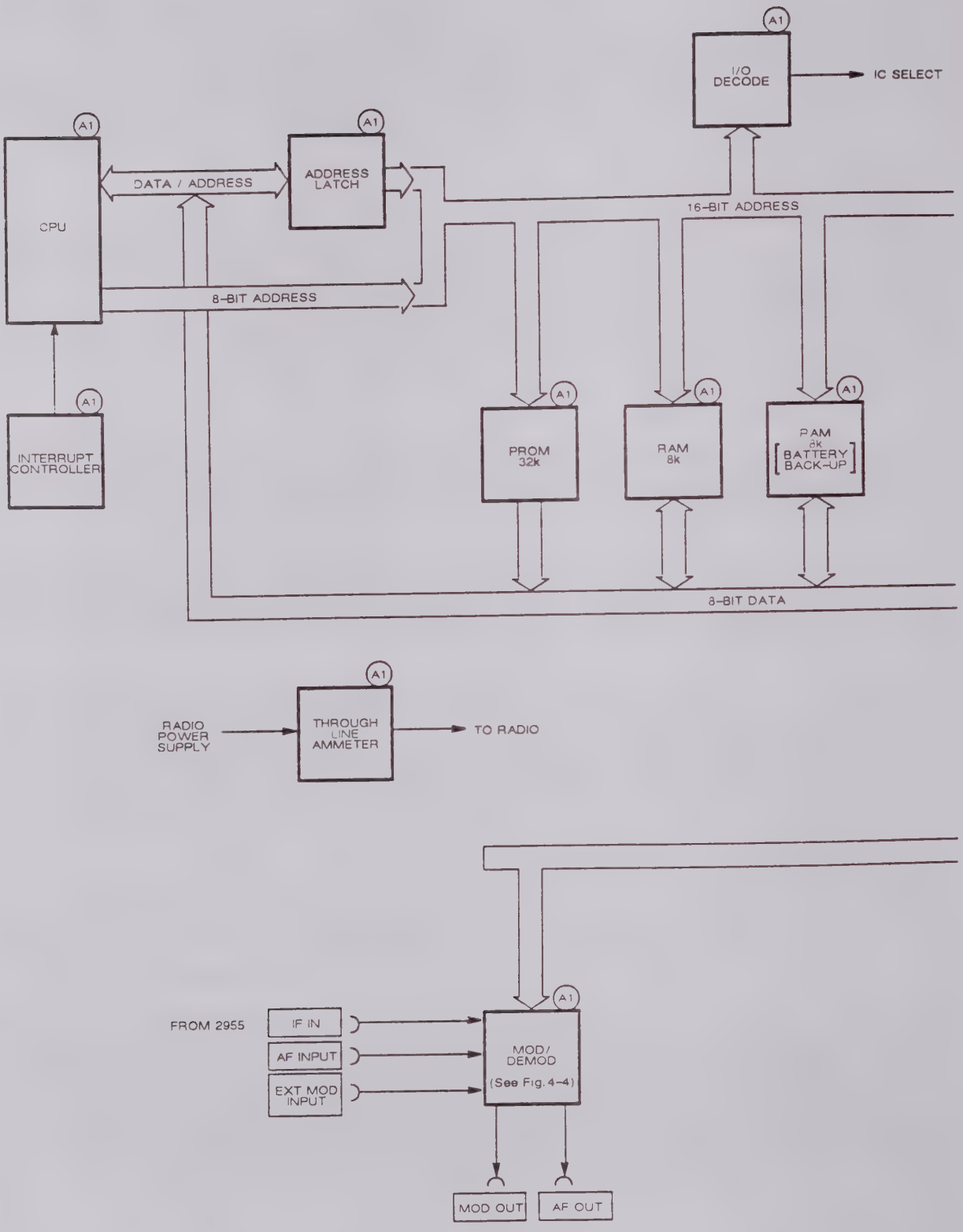
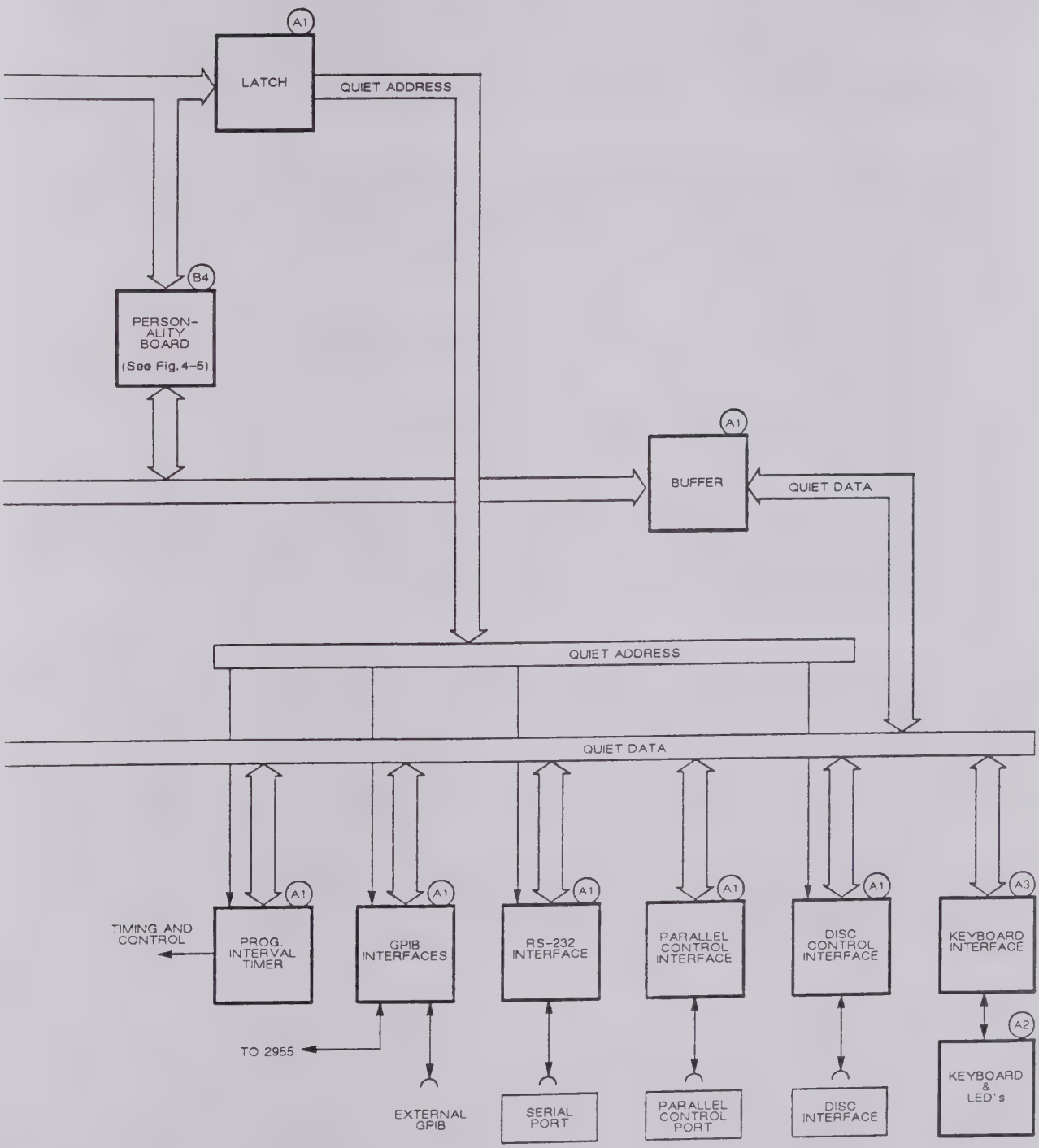


Fig. 4-2 Motherboard circuits


A1
LATCH
QUIET ADDRESS
B4
PERSON-
ALITY
BOARD
(See Fig. 4-5)
A1
BUFFER
QUIET DATA
QUIET ADDRESS
QUIET DATA
A1
PROG.
INTERVAL
TIMER
TIMING AND
CONTROL
A1
GPIB
INTERFACES
TO 2955
EXTERNAL
GPIB
A1
RS-232
INTERFACE
SERIAL
PORT
A1
PARALLEL
CONTROL
INTERFACE
PARALLEL
CONTROL
PORT
A1
DISC
CONTROL
INTERFACE
DISC
INTERFACE
A3
KEYBOARD
INTERFACE
A2
KEYBOARD
&
LED's

Interval timer

16. Programmable interval timers IC20 and IC21 each contain three independently programmable 16-bit down counters. To program each of the counters, the control register is addressed on lines A0 and A1. The control data is sent on D0 to D7 when WR is taken low. The data selects the counter and defines its mode of operation. All clock inputs to the counters are obtained from IC1. Inputs CLK0 and CLK1 at 3.84 MHz are obtained directly from IC1 while input CLK2 at 60 kHz is obtained after division by 64 in IC61.

17. Counter 1 output on OUT0 is used to provide a clock for UART IC34. Counter 2 output is used to provide a clock from OUT1 on line REFCLK to the personality board B4. Counter 3 output provides the timing reference for the software by generating a negatively-going pulse every second which provides interrupt request IR4 for interrupt controller IC12.

GPIB interfaces

18. There are two intelligent GPIB interface circuits IC24 and IC17. IC24 controls the data flow between the Adapter and the external GPIB using transceivers IC22 and IC23. Similarly, IC17 controls the internal GPIB to the 2955 using transceivers IC18 and IC19. The circuits perform address recognition, message transmission and reception, interface function control and provide status information.

19. Each circuit contains 16 registers, 8 read and 8 write. The registers are used for the temporary storage of data to and from the quiet I/O data bus. When WR or RD is taken active low, data on lines D0 to D7 is written into the write register or read out from the read register which is specified by the address on lines RS0 to RS2. INT outputs supply the interrupt requests IR0 and IR1 to the interrupt controller IC12.

20. For both interface circuits, the GPIB commands or data are conveyed on lines DIO0 to DIO7 through transceivers IC22 and IC18 to bus lines DIO1 to DIO8. Similarly, handshake lines DAV, NRFD and NDAC and bus management lines IFC, ATN, SRQ, REN and EOI use transceivers IC23 and IC19. T/R1 to T/R3 perform transmit and receive control for the transceivers.

21. As an example of their operation, when the Adapter is acting as controller of the 2955, IC17 takes the DC (direction control) input to IC19 low in order to assert ATN, REN and IFC on the bus management lines. When acting as a talker, the TE (talk enable) input to IC19 is taken high in order to assert DAV during the handshake on the data transfer lines. The three handshake lines are open-collector so the slowest external device controls the data rate.

Disc controller

22. Disc controller IC31 controls the flow of data and commands between the Adapter and the disc drive. To program the controller to perform the required functions and to read the current settings and status, the microprocessor addresses the internal registers using lines A0 and A1 and places the command data on lines D0 to D7. The internal registers, data, track, sector, command and status are read from or written to when R/W is taken high or low respectively with CS held low. Line MR (master reset) resets IC31 and initializes the status register. The CLK input is an 8 MHz square wave from crystal XL6.

23. The data register holds the data which is transferred in and out in parallel form. This data is assembled in parallel from the serial clock and data pulses from the drive on line RD and is converted to serial form for the drive on line WD. The track register holds the current read/write head position. This is incremented at each pulse from STEP whenever DIRC is taken high to step in towards the centre of the disc. When DIRC is taken low, the head is stepped out towards track 00 and STEP decrements the track register. The sector register holds the address of the desired sector position. The command register holds the command currently being executed and the status register holds the status byte.

24. All the input and output signals between the disc controller and the drive go through buffers IC32 and IC33 respectively. INDEX is pulsed high when the index hole is encountered on the disc. TRACK 00 is taken high whenever the read/write head is positioned over track 00. WRITE PROTECT is sampled whenever a write command is received. If this is low, it prevents a write operation. WRITE GATE is taken high to indicate that the data is valid prior to writing on disc. MOTOR ON enables the spindle motor prior to a read, write or stepping operation. Additional outputs from buffer IC33 are the active low drive select signals DS0 and DS1 and the SIDE SELECT signal.

RS-232 interface

25. IC34 is a USART which performs asynchronous data control between devices connected to the RS-232 port and the Adapter. The USART accepts data in parallel format and converts it into a serial stream for transmission to the external device. Simultaneously, it can receive serial data from the external device and convert it into parallel format. It is interrupt driven and signals to the microprocessor whenever it can receive a new character for transmission or whenever it has received a character. The microprocessor can read the status of the USART at any time.

26. At initialization, IC1 addresses IC34 by taking CS low and then setting A0 to the C/D input high and line WR low to send a set of control words on the data bus. Subsequently, a high RESET pulse can force the USART into an idle state to enable a new set of control words to be written in.

27. Serial data is clocked in and out of IC34 at the selectable baud rate which is derived from the output from the counter 0 of programmable interval timer IC21 which is connected to TxC and RxC. As each character is received on line RxD, the start, stop and parity bits are stripped off. The serial input data is then assembled in a receive buffer within the IC and, when the character is complete, RxRDY takes IR6 high to interrupt controller IC12 to request an interrupt. When it is ready to read the character, IC1 addresses the USART using line CS, then takes C/D and RD low and accepts the data on the I/O data bus.

28. When it is able to accept a character for onward transmission to the external device, the USART takes TxRDY high to request an interrupt on line IR5 to IC12. When it is ready with a character, IC1 places the data on the bus, addresses the USART on input CS and then takes lines C/D and WR low. The character is accepted by a transmit buffer within the IC and the start, stop and parity bits are added and then it is serially clocked out on the line TxD to the bus. The data is handshaken using the output line RTS and the input line CTS.

29. The lines RxD, TxD, RTS and CTS are connected to level shifters which convert between the TTL and the RS-232 ±12 V logic levels. The clock output from IC1 is fed directly to the CLK input of IC34 to provide the internal timing and it is fed to the TxC and RxC inputs through IC21 to provide the much slower data bit rate.

Parallel control port interface

30. IC39 is a bus transceiver with internal registers which operates in conjunction with transceiver IC42. They control the flow of data between the bus to the parallel control port (bus B) and the internal I/O data bus (bus A). On IC39, SAB and SBA are both tied high in order to configure the IC to operate in storage mode. In this mode, data from either or both buses may be stored in the registers and the data subsequently transferred from the registers to the other buses. These storage and transfer operations are controlled by the logic levels on enable inputs GAB and GBA and clock inputs CAB and CBA. The logic levels and the functions performed are shown in Table 4-1.

31. Input TE on IC42 is tied to input GAB on IC39 so that whenever GAB is taken low, the drivers to the data output lines to the control port are taken high impedance. When GAB is taken high, the receivers for the data input lines from IC39 are taken high impedance. This ensures that the unused data lines are disabled during IC39 operation.

TABLE 4-1 PARALLEL CONTROL PORT TRANSCEIVER OPERATION

Enable		Clock		Bus		Function
GAB	GBA	CAB	CBA	A	B	
Low	High	Rising	Rising	In	In	Store A and B data
Low	Low	Any	High	Out	In	Stored B data to A bus
High	High	High	Any	In	Out	Stored A data to B bus
High	Low	High	High	Out	Out	Stored A data to B bus and stored B data to A bus

SAT generator

32. See block diagram Fig. 4-3.

33. To generate an SAT (supervisory audio tone), three counter sections from the programmable interval timer IC20 are connected to IC52. IC52 is a phase-locked loop consisting of a VCO and a phase comparator. The signal input is provided by the 3.84 MHz system clock after division by 24000 in counter 1 of IC20. The resulting 160 Hz reference is applied to one of the two phase comparator inputs in IC52. Components C5, R52 and R53 and the DC output from the comparator LP filter are used to control the VCO in the range 96 to 256 kHz. Part of this signal is fed back through counter 2 of IC20 to provide 160 Hz to the second input to the phase detector in IC52. When in lock, the VCO frequency depends upon the programmable interval timer divider ratio. This is set so that the phase detector inputs are always at 160 Hz. At the lowest setting, the VCO frequency is 160 x 600 = 96 kHz and, at the highest setting, it is 160 x 1600 = 256 kHz. The main output is divided by 4 in the counter 0 of IC20 to provide 24 to 64 kHz for IC51.

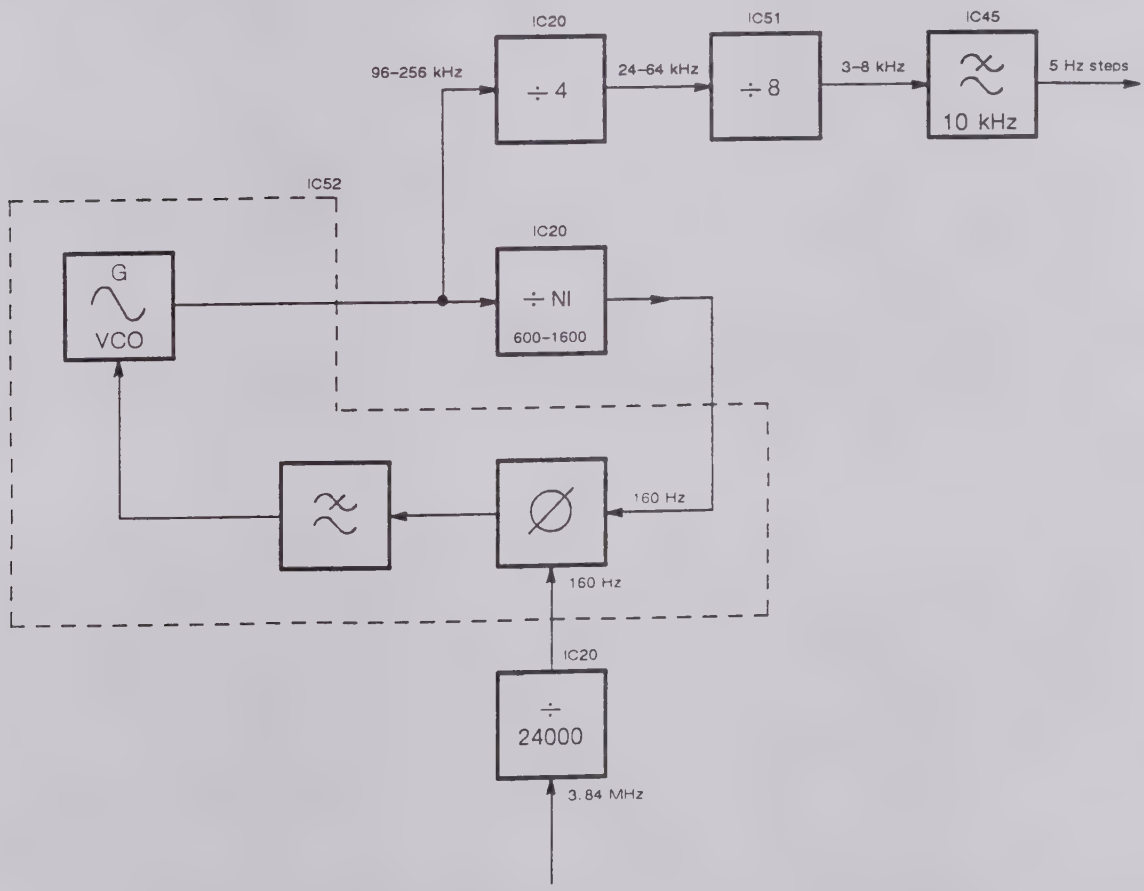


Fig. 4-3 SAT generator circuits

34. The output from counter 0 of IC20 is applied to the clock input of IC51 which is configured as a divide by 8 counter with decoded outputs. Normally, decoded outputs O0 to O8 are at a low logic level but are pulsed high on the positive edge of the clock, each in its respective time slot. Output O8 is connected to the reset input so that, when this output goes high, it resets all the decoded outputs to zero. Due to the values of the resistors on the O0 to O7 outputs, a sequence of pulses is generated of different amplitudes which produces an 8-step sinewave approximation one eighth of the input frequency. The output is thus in the frequency range of 3 to 8 kHz in steps of 5 Hz (i.e. the 160 Hz PLL reference divided by 32). This is fed to the 10 kHz unity gain low-pass filter which is formed by IC45b and IC45a to remove harmonics of the output sinewave. This is followd by voltage follower IC45c

Modulation output

35. IC28, IC44a and IC44d form a programmable attenuator to allow setting of the modulation output level. IC28 consists of two multiplying DACs which are fed from latches which have a common 8-bit data input on lines D0 to D7 from the I/O data bus. These inputs set the output level. The appropriate DAC is selected by A0 and loaded from the bus when WR is low with CS low. When address line A0 is low, DAC A is written to and, when A0 is high, it is DAC B which is written to. For all other conditions, the data is held latched in the device. The modulating input voltage for DAC A is supplied from the filter while that for DAC B is the modulation input from the personality board B4. The two DACs feed to amplifiers IC44a and IC44d which have their feedback paths connected to the RFBA and RFBB inputs to IC28 in order for this IC to control their gains. Either or both inputs may be selected for output. To switch off an input, the data lines are taken low prior to a write operation.

36. The outputs from DAC IC28 are summed by IC44c with the output from IC45d. The voltage follower IC45d has switched inputs enabling it to select between the EXT MOD IN socket and another input which is not used. The summed modulation outputs are fed to the 2955 through the front panel MOD OUT socket.

IF input

37. The 110 kHz IF from the 2955 is routed through the rear panel IF IN socket to IC46 which is a second-order 85 kHz high-pass filter. This removes unwanted low frequency components. The signal is then taken to limiter IC57 which produces an output at TTL level. IC57 is a Schmitt trigger with 100 mV hysteresis to provide a degree of noise immunity. The limited IF is then fed to monostable IC48 which has a nominal pulse width of 3 μs and forms a pulse-type discriminator. This produces pulses of fixed width but with a varying mark/space ratio due to the modulation of the IF. The discriminator output passes to a sixth-order 20 kHz low-pass filter IC49a, IC49d and IC49c which has a gain of 4. The signal is now a demodulated FM plus a DC proportional to the peak pulse height. The additional DC, which is set by R61, effectively eliminates the DC shift on the output of IC49c which occurs when an IF is suddenly applied. This removes the transient effects which are caused by C26 and R71. This process results in much faster demodulation. The output is fed through IC49b with the level set by R73.

Bi-directional switches

38. See block diagram Fig. 4-4.

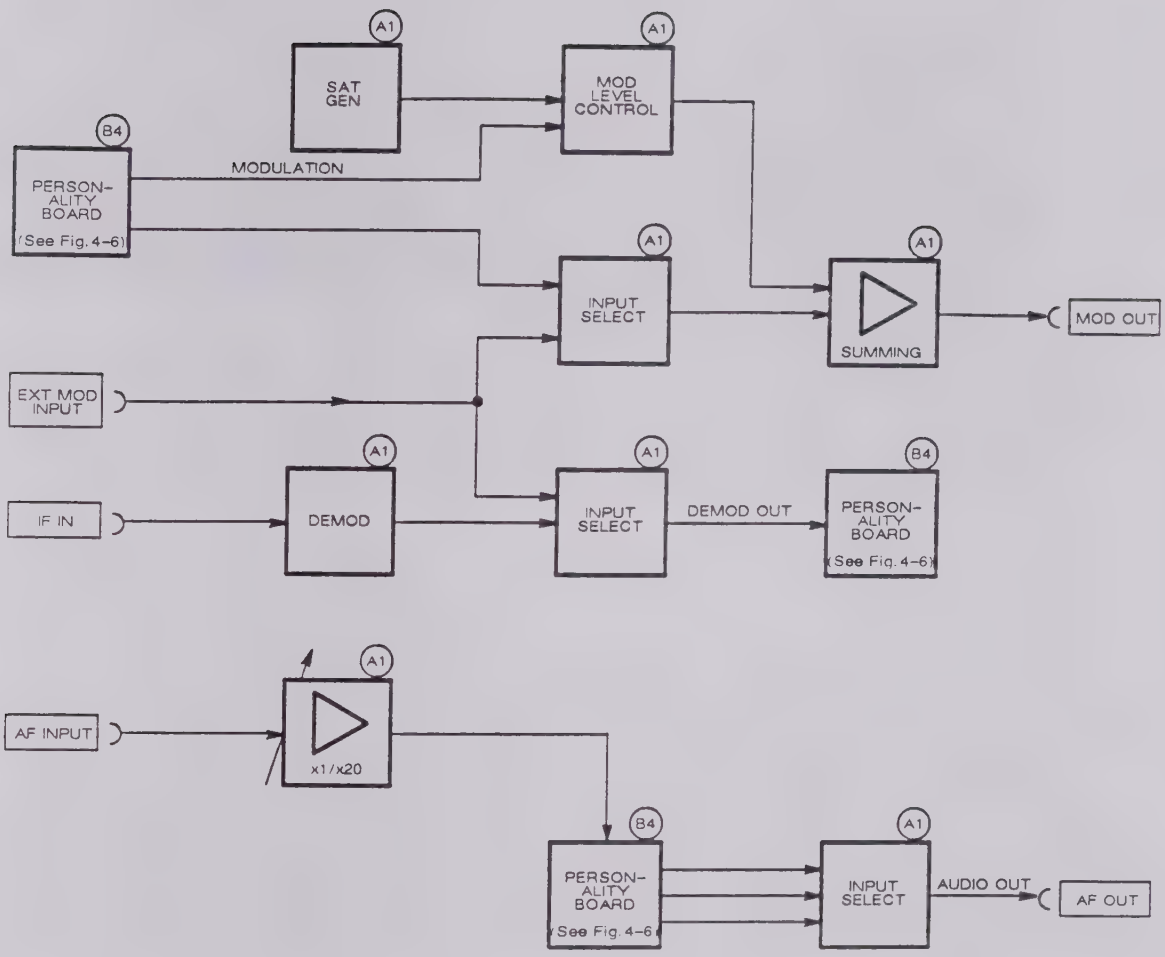


Fig. 4-4 Signal routeing circuits

39. IC26 and IC27 are 8-channel bi-directional switches. Each IC consists of four latches and a binary decoder. The latches are connected to the I/O data bus and the binary decoder is connected to eight switch sections. On each IC, three of the latches are used for the selection data A0, A1 and A2 and the fourth one is used for the enable signal. When WR is taken low, the selection logic is decoded and, when enable is taken high, the addressed switches are closed. As soon as WR returns high, the data, and therefore the switch selection, is held latched in.

AF input

40. The audio input from the AF INPUT socket is fed to switched-gain amplifier IC50b. If the input level is below a threshold of about 100 mV, the gain is switched from x1 to x20. This is done by changing the configuration from a voltage follower to a non-inverting amplifier thus connecting R95 into circuit using IC53d. The output is fed to the personality board B4.

Through-line ammeter

41. A through-line ammeter is provided by IC54 and IC55 which together form a current to voltage converter. To measure the DC taken by the mobile, its DC supply is fed through 0.01 Ω resistor R1. The voltage which is developed across the resistor supplies the inputs to differential amplifier IC54. The output is fed to the x20 amplifier IC55 which has its gain set by R82 so that, for a 10 A input to R1, a 1 V output results. The single-ended DC voltage is also attenuated by R75 and R76 (a ratio of 1/25) in order to measure the DC voltage which is supplied to the mobile.

KEYBOARD A2

42. See circuit diagram Fig. 7-6.

43. This board contains the 2955, CRTS, DISC and PSOPH keys together with their associated LEDs.

44. When any of the keys is pressed, it connects the earth at line SKA5 to one of lines SKA1 to SKA4 so taking its output logically low. These outputs are fed to PLA on the power supply board A4.

45. LEDs D1 to D4 operate in association with the 2955, CRTS, DISC and PSOPH keys respectively. The four LEDs all have their anodes connected to line SKA6 which is supplied with +5 V from the power supply board A4. The LEDs have their cathodes connected through current-limiting resistors R1 to R4 to inputs SKA7 to SKA10. When any of these inputs is taken logically low from the motherboard A1 through the keyboard interface board A3, the appropriate LED lights.

KEYBOARD INTERFACE BOARD A3

46. See circuit diagram Fig. 7-6.

47. This board is used to detect the operation of the keys on the keyboard A2. It also serves to connect the motherboard A1 to the LEDs on the keyboard.

48. The 2955, CRTS, DISC and PSOPH keys on the keyboard A2 are connected through PLA1 to PLA4 to the data inputs of tristate buffer IC2. Normally, these inputs are held logically high by pull-up resistors R1 to R4. Whenever a push-button is pressed, the associated input is taken logically low. Since any input to NAND-gate IC1b going low causes its output to go high, a high RST7 interrupt request is sent to the microprocessor on the motherboard A1. When it is ready, the microprocessor takes line IOS7 low which enables buffer IC2 and allows the keyboard data to be read to identify the key being used.

49. This board also connects, through lines D1 to D4, an output buffer on the motherboard A1 to the keyboard A2 in order to provide the drive to the LEDs.

PERSONALITY BOARD B4

Digital circuits

50. See block diagram Fig. 4-5 and circuit diagram Fig. 7-9.

51. From the motherboard A1, the address bus, the data bus, control lines and power lines are connected through connector SKB to EPROMs, buffers, latches and address decoders. The read line is fed through buffer IC19d and IC19c.

52. The Adapter can accept up to six co-resident system options. For each of these, there is an EPROM IC1 to IC6. All occupy the same 16 Kbyte on the memory map. One EPROM (i.e. page) is selected at a time.

53. The address bus is connected to decoder IC32 (a PAL). This provides enable signals for ICs which both read and write to the bus.

54. The address bus is connected to decoder IC36. This provides enable signals for ICs which exclusively read or write.

55. The data bus is connected to buffer IC33. This provides a quiet data bus to reduce induced noise in the analogue circuits which are nearby.

56. The quiet data bus is fed through latch IC34. Three of the output lines are used for the upper three bits of EPROM addresses. Another three of the output lines are fed to decoder IC35. This provides a page select signal for each of the EPROMs.

57. The quiet data bus is fed through latches IC37 and IC38 to analogue switches.

58. The quiet data bus is connected through buffer IC39 to input lines from analogue detector circuits.

Analogue circuits

59. See block digram Fig. 4-6 and circuit diagrams Fig. 7-7 (modems), Fig. 7-8 (tone filters and detectors) and Fig. 7-10 (psophometric filters).

60. The demodulated signal is fed from the motherboard A1 through connector SKA in parallel to the following circuits:-

Circuit	Systems
1200 baud FFSK modem	NMT, RC2000, Band III
10000/8000 baud FSK modem	AMPS, TACS
50 baud FSK modem	RC2000
DTMF receiver	AMPS, TACS, RC2000
4 kHz SAT filter	NMT
6 kHz SAT filter	AMPS, TACS
Signalling tone filter	AMPS, TACS
De-emphasis filter	All
AF output circuit	All

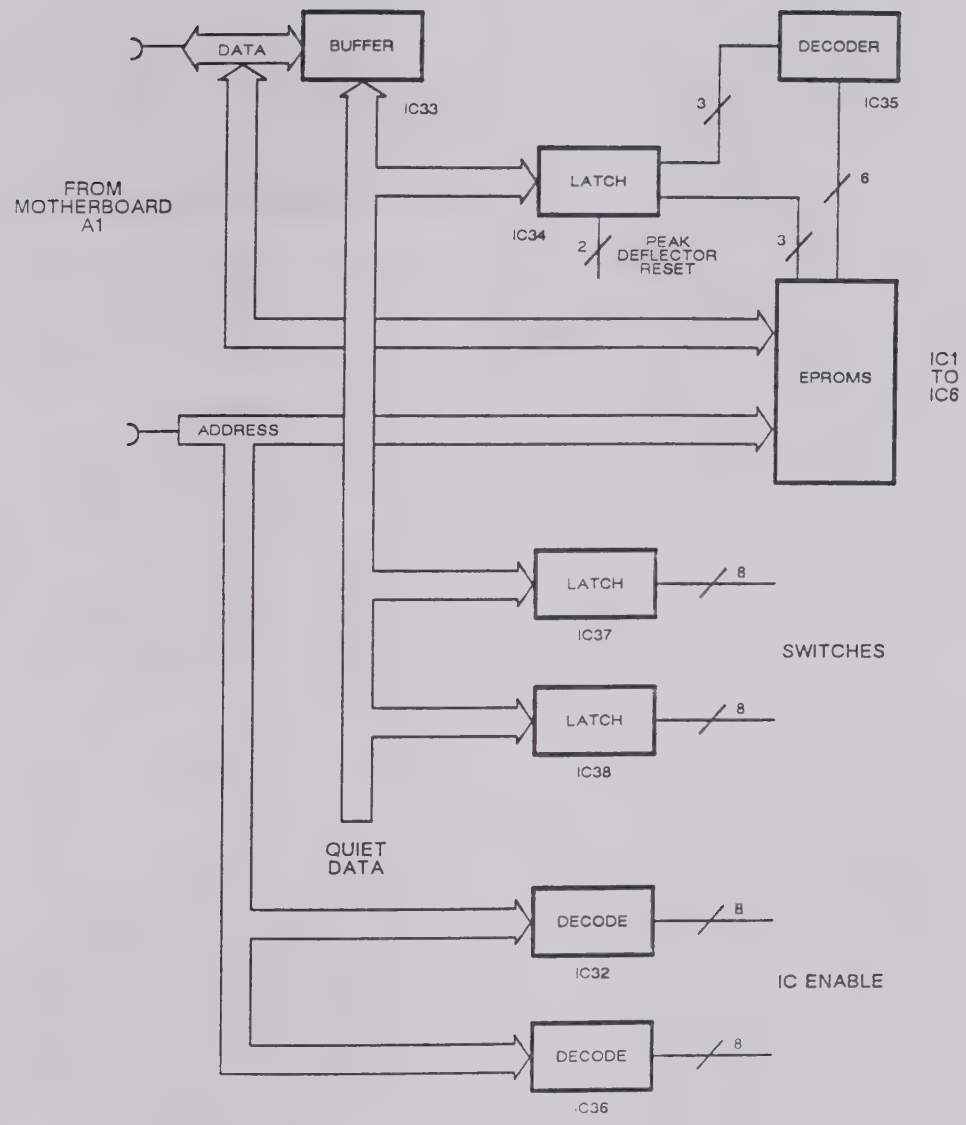


Fig. 4-5 Personality board digital circuits

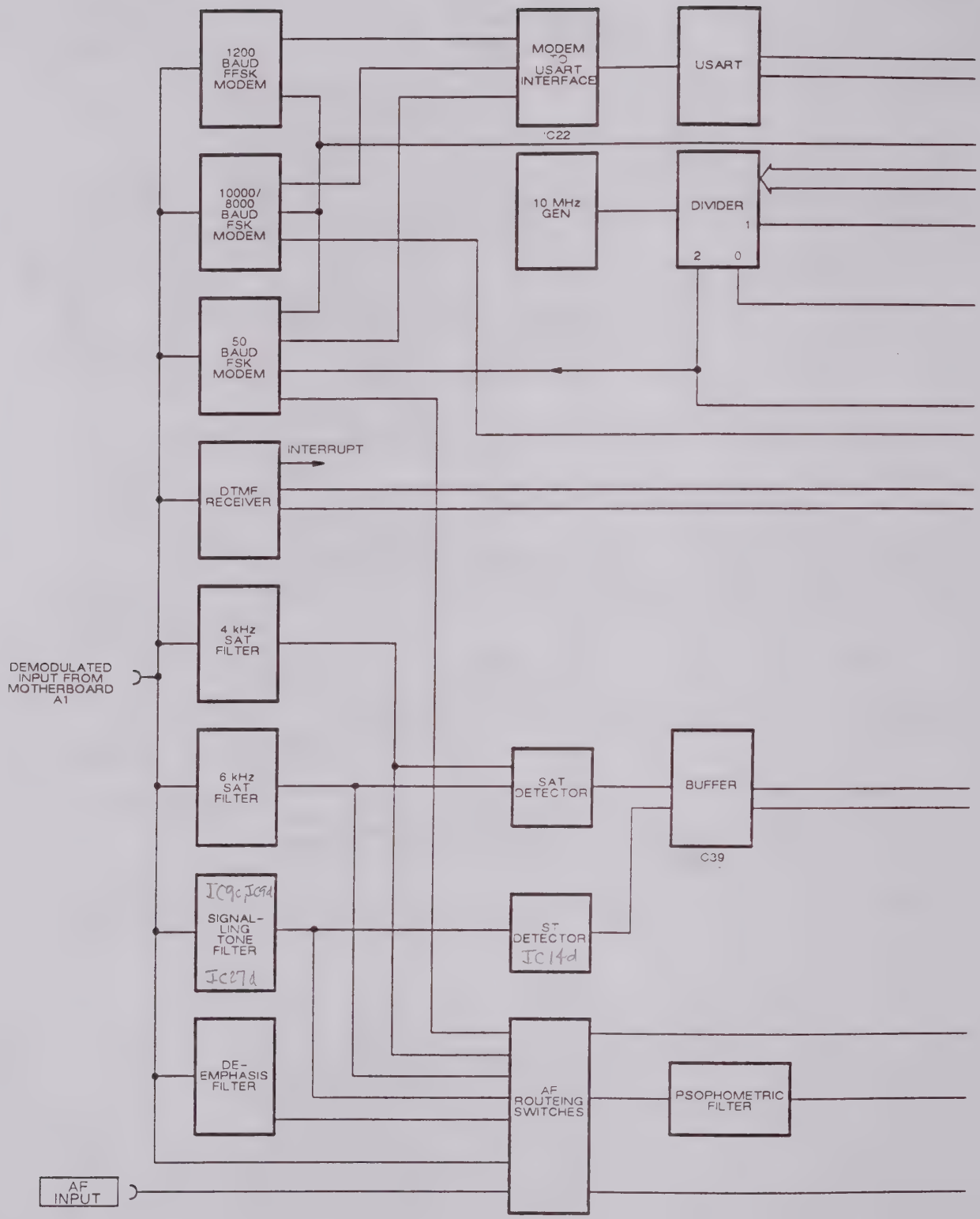
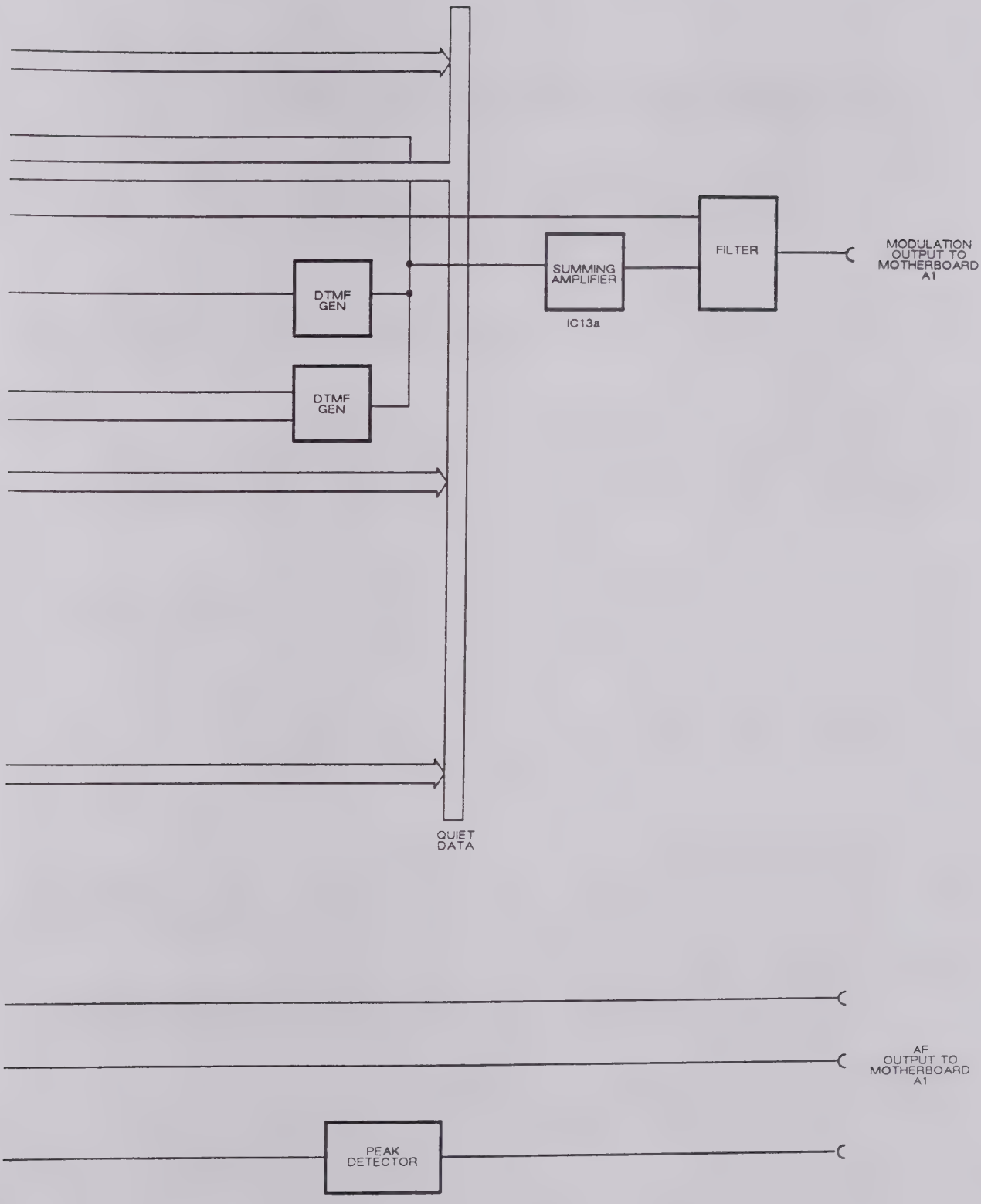


Fig. 4-6 Personality board analogue circuits


DTMF GEN
DTMF GEN
SUMMING AMPLIFIER
IC13a
FILTER
MODULATION OUTPUT TO MOTHERBOARD A1
QUIET DATA
AF OUTPUT TO MOTHERBOARD A1
PEAK DETECTOR

61. The modulation output signal is fed to the motherboard A1 through connector SKA in parallel from the following circuits:-

Circuit	Systems
1200 baud FFSK modem	NMT, RC2000, Band III
10000/8000 baud FSK modem	AMPS, TACS
50 baud FSK modem	RC2000
DTMF generators	AMPS, TACS, RC2000

62. The AF output signal, for measurement of level and/or frequency by the 2955, is fed to the motherboard A1 through connector SKA from the following circuits:-

Circuit	Systems
50 baud FSK modem	RC2000
4 kHz SAT filter	NMT
6 kHz SAT filter	AMPS, TACS
Signalling tone filter	AMPS, TACS
De-emphasis filter	All

63. The AF output signal is fed direct to the motherboard A1 direct or through one of the following weighting filters:-

Circuit	Circuit
CCITT psophometric filter	NMT, TACS
C-message psophometric filter	AMPS

1200 baud FFSK modem

64. The AF signal from SKA is fed to amplifier IC9b. There is a switch IC24c to set the gain at 1 (switch open) for NMT or at 2 (switch closed) for RC2000 and Band III. The output from IC9b is limited by diodes D8 and D9 to protect the following modem IC11 from excessive signals and from spikes.

65. The IC11 data lines are connected to modem to USART interface IC22. The AF output from IC11 is fed through filter R11, C121 and R172 to summing amplifier IC13a. The filter rejects the clock frequency so that in-band beat frequencies are not produced in later stages.

10000/8000 baud FSK and Manchester modem

66. The AF signal from SKA is fed to comparator IC14b which produces a squared digital signal. Hysteresis prevents the circuit from being triggered by small amounts of noise. The digital signal is fed to modem IC17 (a PAL).

67. The IC17 data lines are connected to modem/USART interface IC22. From IC17, the Manchester output is fed through filter R105, C112 and R41 to summing amplifier IC13a. There is provision for an FSK output through filter R104, C111 and R40 but this is not used. The filters reject the clock frequency so that in-band beat frequencies are not produced in later stages.

68. The clock frequency is recovered from the incoming signal by phase-locked loop IC16. There is a switch IC24d to select 10 kbit/s (switch closed) for AMPS or 8 kbit/s (switch open) for TACS.

50 baud FSK modem

69. The AF signal from SKA is fed through bandpass filter IC44a and IC44b, which passes only the RC2000 infraband (150 ±14 Hz), to comparator IC14b which produces a squared digital signal. Hysteresis prevents the circuit from being triggered by small amounts of noise. The digital signal is fed to modem IC15. Also, the bandpass filter is connected to a routeing switch in the AF output circuit.

70. The IC15 data lines are connected to modem to USART interface IC22. The AF output from IC15 is fed through filter R103, C110 and R17 to summing amplifier IC13a. The filter rejects the clock frequency so that in-band beat frequencies are not produced in later stages.

Modem to USART interface and USART

71. The data lines of the above three modems are selected by interface IC22 (a PAL) which connects the selected lines to USART IC23. This converts between the modems' serial data and the microprocessor's parallel data.

DTMF receiver

72. The AF signal from SKA is fed to receiver IC21 which detects each tone pair and generates an interrupt signal for the microprocessor on the motherboard A1. The appropriate numerical value is fed to the quiet data bus.

DTMF generators

73. 10 MHz is generated in the oscillator circuit which contains crystal XL3. This is fed to programmable divider IC18 which provides clock signals to two DTMF generators, to the 50 baud FSK modem and to the modulation output circuit.

74. A clock output is fed to generator IC10 to produce a staircase sinusoidal waveform which is fed through filter R109, C114 and R108 to summing amplifier IC13a. The filter rejects the clock frequency so that in-band beat requencies are not produced in later stages.

75. A clock output is fed to NAND gate IC19a along with the DTMF output from the FSK and Manchester modem IC17. This second (higher) DTMF tone is fed through filter R106, C113 and R42 to summing amplifier IC13a. The filter rejects the clock frequency so that in-band beat frequencies are not produced in later stages.

Modulation output circuit

76. The three modems and the DTMF generators are connected to summing amplifier IC13a. There is provision for an external input but this is not used.

77. The output is fed through a variable-frequency low-pass filter which consists of switched-capacitor circuit IC12. This gives a sinusoidal waveform from the synthesized waveform. The cut-off frequency depends on the generated signal and is controlled by the clock input from the first DTMF generator.

78. There is then a low-pass clock filter R25, C15, C16 and R26. There is a switch IC25a to connect (switch closed) or disconnect (switch open) C15 for a lower or higher cut-off frequency. This filter is followed by buffer IC13b.

SAT filters and detector

79. The AF signal from SKA is fed to 4 kHz band-pass filter IC26a, IC26b and IC26c. When there is a filter output, it is fed to summing amplifier IC26d and to the AF output circuit. There is a switch IC24a to disconnect the circuit (switch open) when it is not being used. This prevents confusion between noise and a very low level SAT signal.

80. The AF signal from SKA is fed to 6 kHz band-pass filter IC27a, IC27b and IC27c. When there is a filter output, it is fed to summing amplifier IC26d and to the AF output circuit. There is provision for another output but this is not used.

81. The two SAT filters are connected to summing amplifier IC26d. This is followed by amplifier IC14c in a detector circuit. When there is an input signal of sufficient level, a signal is fed through buffer IC39 to the data bus.

Signalling tone filter and detector

82. The AF signal from SKA is fed to high-pass filter IC9c, IC9d and IC27d. The filter shape gives a similar output from the higher level at 10 kHz for AMPS than at 8 kHz for TACS. When there is a filter output, it is fed to the signalling tone detector and to the AF output circuit.

83. The signalling tone filter is connected to amplifier IC14d in a detector circuit. When there is an input signal of sufficient level, a signal is fed through buffer IC39 to the data bus.

De-emphasis filter

84. The AF signal from SKA is fed to low-pass filter IC9a which produces the required de-emphasis. The output is fed to the AF output circuit.

AF output circuit

85. The AF signal line from SKA, the 150 Hz bandpass filter, the 4 kHz SAT filter, the 6 kHz SAT filter, the signalling tone filter, the de-emphasis filter and the front panel AF INPUT connector are connected to routeing analogue switches IC29b, IC29d, IC25c, IC25d, IC29a, IC24b and IC29c. These select the signal to the 2955 and, through buffer IC13d, to peak detector circuit IC28a, IC28b, IC28c and IC28d. There is provision for an external output but this is not used.

86. In the peak detector circuit, each half cycle is rectified by D6 or D7 and these charge C41 and C42 to the peak values. Feedback compensates for capacitor leakage and diode bias. There are switches IC30c and IC30b to hold the peak level (switch open) or to track the input signal (switch closed). There are switches IC30a and IC31b to feed out the positive (IC30a closed) or negative (IC31b closed) half-cycle value to the 2955.

Psophometric filters

87. The AF signal from the routeing switches is fed to two common filter stages IC40a and IC40b. There is then a buffer IC40c to two separate CCITT and C-message filters. The CCITT filter consists of six stages IC40d, IC41a, IC41b, IC41c, IC41d and IC42a. The C-message filter consists of five stages IC43a, IC43b, IC43c, IC43d and IC42c. After each filter, there is an amplifier IC42b and IC42d followed by selection switches IC31c and IC31d respectively. In each amplifier, there is a preset resistor to set unity gain.

AC POWER SUPPLY BOARD A4

88. See circuit diagram Fig. 7-1 (overall).

89. The AC supply is fed through fuses FS1 and FS2, on/off switch SA and voltage selector SB to mains transformer T1.

90. See circuit diagram Fig. 7-11 (board A4).

91. The mains transformer's high-current secondary is connected to full-wave rectifier D1 to D4. This produces a mean rectified DC of 15 to 20 V across capacitors C1 and C2. These are connected to 3-terminal regulator IC1 which provides the +12 V supply.

92. C1 and C2 are also connected to switching regulator IC3 through fuse FS1 and inductor L1. IC3 consists primarily of a comparator and an oscillator. The inputs to IC3 are peak current sense which is developed across resistor R1 and a voltage from feedback resistor network R2, R5 and R6 in parallel with capacitor C10. If the voltage across C10 falls below 5V, an output from the comparator within IC3 causes an increase in oscillator pulse width. The oscillator free run pulse length is determined by capacitor C7. IC3's output pulse train is approximately 15 V at a nominal 25 kHz and this is fed to the bases of emitter followers TR1 and TR2. Bias resistors R3 and R4 and Zener D5 prevent the voltage on the bases of TR1 and TR2 going above 18V.

93. TR1 and TR2 provide sufficient gate current to FET TR3 to overcome its high input impedance and facilitate rapid switching. The increased pulse width from IC3 results in TR3 being on for longer periods which increases the output voltage across C10. When TR3 turns on, the current through L2 does not increase rapidly but in a gentle ramp, the peak of which is detected by IC3. This causes the output pulse length to fall back to normal and reduce the time TR3 is on until the voltage across C10 falls below 5V again.

94. Zener D6 prevents the output going negative. Inductor L3 and capacitor C11 provide smoothing. Overvoltage protector IC4 turns hard on under a fault condition when the output voltage exceeds 6V. Short-circuit protection is provided by R1 and FS1 which limit the current to 3 A.

95. The mains transformer's low-current secondary is connected to full-wave rectifier D7. This produces a mean rectified DC of 15 to 20 V across capacitor C5. This is connected to 3-terminal regulator IC2 which provides the -12 V supply.

AC/DC POWER SUPPLY BOARD A7

96. See circuit diagram Fig. 7-1 (overall).

97. The AC supply is fed through fuses FS1 and FS2, on/off switch SA and voltage selector SB to mains transformer T1.

98. See circuit diagram Fig. 7-12 (board A7).

99. The mains transformer's high-current secondary is connected to full-wave rectifier D1 to D4 which provides power to the coil of relay RLA. When AC is present, RLA is energized so that AC is fed through.

100. When RLA is not energized, DC is fed through fuse FS1 to low-pass filter C1, L1 and C2 and then through RLA. The filter prevents high-frequency noise being radiated by the input wiring. Change-over of the relay is fast enough to prevent the power outputs from glitching.

101. AC or DC is fed through full-wave rectifier D5 to D7 to smoothing capacitors C3 and C4.

102. Controller IC1 with resistor R9 and capacitor C10 provide 100 kHz so that FETs TR4 and TR5 are switched on in alternate cycles, chopping the input voltage into positive and negative pulses of varying widths across the primary of transformer T2.

103. The current into T2 is detected by transformer T1, diode D8, capacitor C12 and resistor R16 and it is fed back through resistor R14 to IC1 which uses it to control the on-times of TR4 and TR5 to keep the power transfer in T2 constant. The feedback loop is kept stable by resistor R15 and capacitor C11 which provide slope compensation. Resistors R7 and R8 set an upper limit on the T2 current. Capacitor C9 provides a soft start by forcing the current limit input to IC1 to rise slowly.

104. Transistors TR1 to TR3, resistors R1 to R4 and capacitors C5 and C6 provide a regulated 8.5 V supply to drive the gates of TR4 and TR5 through IC1. Connectors PLA and PLB allow the gate drives to be disconnected for test purposes. Resistors R10 and R13 prevent ringing at the gates of TR4 and TR5. Resistors R11 and R12 protect TR4 and TR5 from static discharge when PLA and PLB are disconnected.

105. The metal can around T2 reduces high frequenct radiation to comply with VDE requirements.

106. The mains transformer's secondaries are connected to rectifiers D9 to D13. After smoothing by inductors L2a to L2c and capacitors C13 to C15, +12.7 V, -12.7 V and 5 V are produced.

107. Diode D17, together with resistors R29 to R32 and capacitor C22, form an adjustable 5 V reference. Amplifier IC3c, capacitor C21 and resistors R27 and R28 form an integrator which compares the 5 V reference with the 5 V output, producing an error voltage.

108. An isolation boundary exists between the primary and the secondaries of T2. Amplifier IC3d, resistors R23 to R26, couplers IC2a and IC2b and resistor R17 transfer the error voltage back across the boundary through resistor R5 to the voltage sense input of IC1. This completes an outer feedback loop which locks the 5 V output to the 5 V reference. Diode D16 prevents a reverse voltage occuring across IC2. Resistor R6 and capacitors C7 and C18 keep the outer feedback loop stable.

109. Amplifier IC3a uses resistors R21 and R22 to check for over-voltage on the 5 V output. If this rises by more than 10% above the 5 V reference, then IC3a turns on transistor TR6 through resistor R20 which short-circuits the 5 V output. This is to protect external components in the event of an over-voltage failure. The circuit resets when the input power is removed. Capacitors C16 and C17 prevent triggering from noise.

Chapter 5-0

MAINTENANCE

CONTENTS

Para.
1 Introduction
3 Safety precautions
4 Test equipment for performance testing
5 Test equipment for adjustment, calibration and fault-finding
6 Access to trays and boards
9 Access to adjustment points

Table Page
5-1 Test equipment for performance testing 2

INTRODUCTION

1. This chapter provides servicing support information for the three following chapters:-

5-1: PERFORMANCE TESTING - Procedures for verifying that the equipment complies with the Performance Data in Chap. 1.

5-2: ADJUSTMENT AND CALIBRATION - Tests and adjustments for restoring the equipment to peak performance.

5-3: FAULT DIAGNOSIS - Procedures for localizing faults at least to sub-assembly level (normally a printed circuit board), together with information on repair and replacement.

2. In case of difficulties which cannot be resolved with the aid of this Manual, please contact our Service Division at the address at the rear of the Manual or your nearest Marconi Instruments representative. Always quote the type number and serial number which can be found on the instrument data plate.

SAFETY PRECAUTIONS

3. Although this equipment has been designed and constructed in accordance with international safety standards, it is important that the advice given at the front of this Manual under OPERATING PRECAUTIONS should be observed in all maintenance procedures to ensure safe working practices.

TEST EQUIPMENT FOR PERFORMANCE TESTING

4. Test equipment which is suitable for use in Chap. 5-1 is shown in Table 5-1. Each item of test equipment is given a letter reference in Table 5-1 and in Chap. 5-1. Alternative equipment may be used provided it complies with the stated minimum specification.

TABLE 5-1 TEST EQUIPMENT FOR PERFORMANCE TESTING

Reference	Description	Minimum specification	Example
a	Distortion meter	3 to 8 kHz, measuring capability <0.2%	Marconi TF 2331A or HP 8903
b	Counter/timer	Period measurement accuracy <5 parts/10^6, ns range accuracy <±5 parts/10^6	Marconi 2437
c	Modulation meter	150 to 1000 MHz, FM noise average, 50 Hz to 15 kHz filter, 300 Hz to 3.4 kHz filter, LF output, FM measurement accuracy <2%	Marconi 2305
d	Signal generator	450 to 1000 MHz, 13 dBm, external FM capability	Marconi 2019A
e	Synthesized LF generator	0 to 7 kHz, 2 V RMS	R & S SPN or HP 3325
f	DVM	AC: RMS accuracy <0.5%, DC volts: 1 MΩ, accuracy <0.5%	Solatron 7150+ or Datron 1065A
g	Rheostat	0 to 100 Ω. 10 A	Berco
h	DC power supply	0 to 25 V, 10 A	Farnell B30/10
j	DVM current shunt	10 A, 0.25% accuracy, sensitivity 10 mV/A	Fluke 80J-10
k	Controller with serial interface	RS-232 compatible with selectable start, stop and parity	HP85 with serial interface
m	Oscilloscope	DC to 5 V display	Tektronix 2235
n	GPIB controller	GPIB output port	HP85 with GPIB 82937A

TEST EQUIPMENT FOR ADJUSTMENT, CALIBRATION AND FAULT-FINDING

5. Test equipment which is suitable for use in Chaps. 5-2 and 5-3 is as follows:-

Description	Example
Counter/timer	Marconi 2437
Signal generator	Marconi 2019A
Synthesized LF generator	R & S SPN or HP 3325
AF generator	Marconi 2000
DVM	Solatron 7150+ or Datron 1065A
Rheostat	Berco
DC power supply	Farnell B30/10
DVM current shunt	Fluke 80J-10
Controller with serial interface	HP85 with serial interface
Oscilloscope	Tektronix 2235
GPIB controller	HP85 with GPIB 82937A

ACCESS TO TRAYS AND BOARDS

6. Access to the Adapter is achieved by either of two methods as follows:-

(1) Turning the two connected units upside down on the bench. This method results in the 2955 screen and controls being inverted.

(2) The fitting of the Adapter on the top of the 2955. This necessitates the use of an extended GPIB cable (MI part no. 43129-189U) and three 1.5 m BNC cables (MI part no. 43126-012S) but avoids the inversion of the 2955.

7. When the method described in para. 5 (1) is to be used, proceed as follows:-

(1) Switch both instruments off and, leaving them connected as normal, turn the entire unit upside down on the bench.

(2) Remove the bottom cover from the Adapter.

8. When the method described in para. 5 (2) is to be used, proceed as follows:-

(1) Switch off both instruments and remove all interconnecting cables.

(2) Disconnect the Adapter from the bottom of the 2955 and fit it upside down on the top of the 2955.

(3) Reconnect the two units together electrically using the normal power cable but the extended GPIB and BNC cables. Remove the bottom cover from the Adapter.

ACCESS TO ADJUSTMENT POINTS

9. Having connected the 2955 and Adapter together in one of the two methods described above, proceed as follows:-

(1) Switch off the AC mains supply and remove the Adapter's power cable.

(2) Remove the six cross head screws which secure the Adapter's bottom panel and remove the bottom panel.

(3) Loosen and remove the two front screws which secure the smaller PCB tray to the instrument side frames.

(4) Loosen and remove the screw in the centre at the rear of the small PCB and the two rear screws which secure the PCB tray to the instrument side frames.

(6) The small PCB together with the tray can now be located in the vertical and secured in this position by replacing and tightening the two rear screws. For extra protection, a sheet of thin insulating material such as card or a small sheet of plastic should be placed between the motherboard and the vertical tray.

Chapter 5-1

PERFORMANCE TESTING

CONTENTS

Para.

1 SAT generator
2 SAT measurement - NMT
3 SAT measurement - AMPS and TACS
4 Psophometric filter - CCITT
5 Psophometric filter - C-message
6 1200 baud FFSK generator
7 FSK and Manchester data generator
8 Infraband data generator
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10 External modulation
11 Disc drive interface
12 Serial control port
13 Parallel control port

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SAT GENERATOR

1. These tests apply to NMT, AMPS and TACS only. When more than one of these systems are available in a single instrument, the tests are only necessary on one system as the circuitry is common.

Distortion

Specification:

SAT generator distortion	Less than 2% at 4 kHz ±45 Hz, less than 2% at 6 kHz ±30 Hz.

Test equipment:

Reference	Description	Minimum specification	Example
a	Distortion meter	3 to 8 kHz, measuring capability <0.2%	Marconi TF 2331A or HP 8903

Procedure:

(1) Switch on the instrument and press the CRTS key.

(2) When the equipment has completed its self-test, select MANUAL TEST.

(3) Select MANUAL TEST and, under MODE, select DATA OFF.

(4) Using the CHANGE key and the data keypad, set the SAT frequency to the first of the following frequencies:-

System	SAT frequencies
NMT	3955, 3985, 4015, 4045 Hz
AMPS	5970, 6000, 6030 Hz
TACS	5970, 6000, 6030 Hz

(5) Set the SAT level to 2.5 kHz and the data level to 0 kHz.

(6) Connect a 50 Ω termination to the Adapter's EXT MOD I/P socket (to cut out any pick-up). Connect the Adapter's MOD O/P socket to the distortion meter input.

(7) Measure the distortion, checking that it is within 2%. (If the 2331A distortion meter is used, the reference should be set on the 10% range due to the low level of output from the Adapter's MOD O/P socket.)

(8) Repeat for the other SAT frequencies.

Frequency and deviation accuracy

Specification:

Frequency range	3 to 8 kHz.
Frequency accuracy	±1 Hz.
Deviation accuracy	±10% for deviations of 300 Hz to 2.5 kHz at system frequencies (3.955 kHz to 4.045 kHz and 5.970 kHz to 6.030 kHz).

Test equipment:

Reference	Description	Minimum specification	Example
b	Counter/timer	Period measurement accuracy <5 parts/10^6	Marconi 2437
c	Modulation meter	RF in up to 1000 MHz FM, noise averaging, 50 Hz to 15 kHz filter, LF output	Marconi 2305

Procedure:

(1) Connect the 2955 RF IN/OUT N socket to the modulation meter RF input socket and connect the counter/timer to the modulation meter LF output socket as shown in Fig. 5-1.

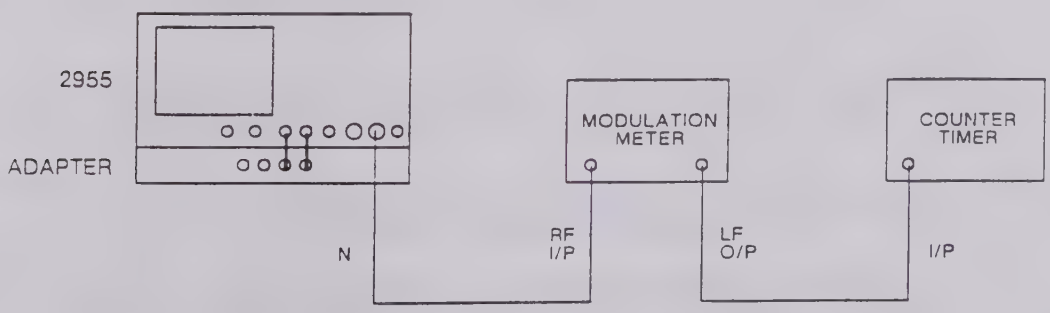

Fig. 5-1 Test equipment for SAT frequency and deviation tests

(2) Switch on the instrument and press the CRTS key.

(3) When the equipment has completed its self-test, select MANUAL TEST.

(4) Select MANUAL TEST and, under MODE, select DATA OFF.

(5) Using the CHANGE key and the data keypad, set the SAT generator to the first row of settings shown in Table 5-2 or Table 5-3, according to the system.

TABLE 5-2 SAT GENERATOR SETTINGS - NMT

SAT frequency	SAT level	Data level	Counter/timer limits
3955 Hz	0.3 kHz	0 kHz	252780.5 to 252908.4
3985 Hz	0.3 kHz	0 kHz	250878.1 to 251004.0
4015 Hz	0.3 kHz	0 kHz	249003.9 to 249128.0
4045 Hz	0.3 kHz	0 kHz	247157.6 to 247279.9

TABLE 5-3 SAT GENERATOR SETTINGS - AMPS AND TACS

SAT frequency	SAT level		Data level	Counter/timer limits
	AMPS	TACS		
5970 Hz	2 kHz	1.7 kHz	0 kHz	67476.2 to 167532.3
6000 Hz	2 kHz	1.7 kHz	0 kHz	166638.9 to 166694.5
6030 Hz	2 kHz	1.7 kHz	0 kHz	165809.9 to 165864.9

(6) The SAT modulated carrier level has to be increased for it to trigger the modulation meter. To achieve this, press 2955 and then RX. If the 2955 key is inadvertently pressed twice (indicated by the 2955 LED on and the CRTS led OFF), the SAT is switched off. (To recover, press CRTS, 2955 and RX).

(7) Set the modulation meter to monitor FM noise average in a 50 Hz to 15 kHz bandwidth. Set the LF level potentiometer to the brown marker (2305).

(8) Set the counter/timer to measure period on the ns range. (This is required to achieve the correct accuracy and resolution.)

(9) Check on the modulation meter that the deviation displayed is within ±10% of the set SAT deviation level.

(10) Check on the counter/timer that the period indicated is within ±1 Hz, (i.e. within the limits shown in the right hand column of the above tables).

Note... If problems are encountered triggering the counter/timer, return to manual operation and increase the SAT level to 2 kHz deviation to carry out the counter measurements. (To return to MANUAL mode, press the CRTS key.)

(11) Repeat the check for the other SAT frequencies.

SAT MEASUREMENT - NMT

2. This test applies to NMT450 and NMT900.

Specification:

Accuracy	±10% at nominal system SAT frequencies and level.

Test equipment:

Reference	Description	Minimum specification	Example
c	Modulation meter	400 to 1000 MHz FM, noise averaging, 50 Hz to 15 kHz filter, measurement accuracy <2%	Marconi 2305
d	Signal generator	450 to 1000 MHz, 13 dBm, external FM capability	Marconi 2019A
e	Synthesized LF generator	0 to 7 kHz, 1 V RMS	R & S SPN or HP 3325

Procedure:

Note... The Adapter measures SAT deviation in a very narrow bandwidth centred on the SAT frequency. Independent filters of this characteristic are not generally available. Therefore, the test method is written around a good quality modulation meter with an internationally recognized filter bandwidth and noise averaging selected.

(1) Connect the LF generator output socket to the signal generator external modulation input socket and connect the signal generator output socket to the modulation meter input socket as shown in Fig. 5-2.

(2) Set the LF generator to give an output of 4.015 kHz at a level suitable for the signal generator being used.

(3) Set the signal generator to a frequency of 456.350 MHz (NMT-450) or 893.3625 MHz (NMT-900), 300 Hz external deviation, RF level 13 dBm.

(4) Set the modulation meter to monitor FM in a 50 Hz to 15 kHz bandwidth with noise average selected.

(5) Note the deviation displayed on the modulation meter.

(6) Switch on the Adapter and press the CRTS key. When the equipment has completed its self-test, check that the correct system is selected (i.e. NMT-450 or NMT-900).

(7) Select MANUAL TEST.

(8) Set the channel to 135 and the mode to COMBINED CC/TC.

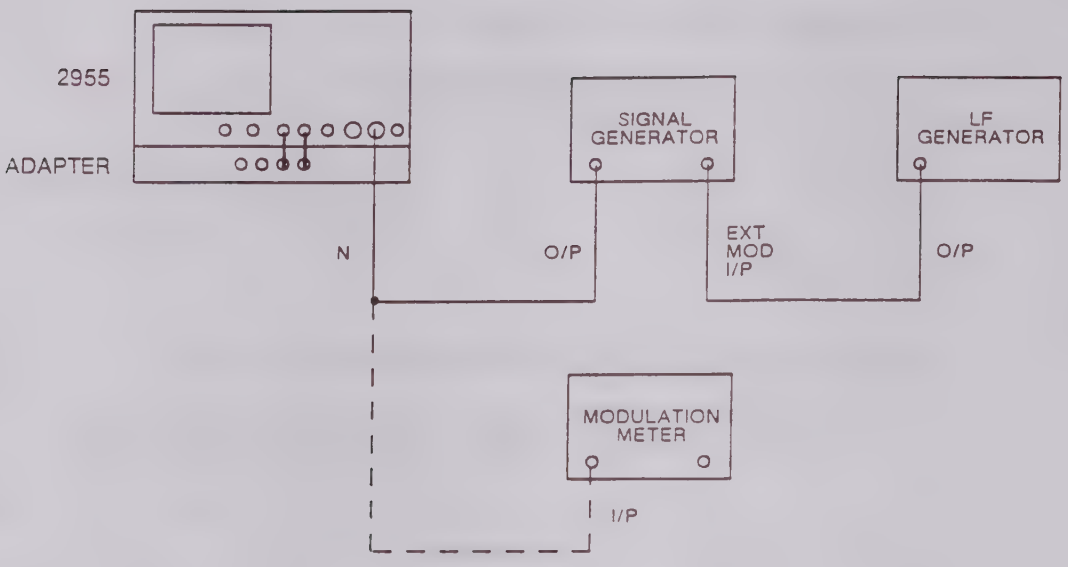

Fig. 5-2 Test equipment for SAT measurement test

(9) Using the CHANGE key and the data keypad, set the SAT generator frequency to the same frequency as that set on the LF generator. The CHANGE key should now have changed to NEXT and the flashing cursor should be under the SAT level.

(10) Press the NEXT key twice. The flashing cursor should disappear. (Although the SAT generator output is not actually used during this check, the SAT generator frequency has to be set always to the same frequency as that set on the LF generator in order to ensure that the correct internal calibration table is used.)

(11) Connect the signal generator output to the 2955 RF IN/OUT N socket.

(12) Check that ON appears in reverse on the screen and that the SAT level displayed is within ±10% of the deviation noted on the modulation meter.

(13) Repeat for LF generator frequencies of 3955, 3985 and 4045 Hz.

SAT MEASUREMENT - AMPS AND TACS

3. This test applies to AMPS and TACS.

Specification:

Accuracy	±10% at nominal system SAT frequencies and level.

Test equipment:

Reference	Description	Minimum specification	Example
c	Modulation meter	400 to 1000 MHz FM, noise averaging, 50 Hz to 15 kHz filter, measurement accuracy <2%	Marconi 2305
d	Signal generator	450 to 1000 MHz, 13 dBm, external FM capability	Marconi 2019A
e	Synthesized LF generator	0 to 7 kHz, 1 V RMS	R & S SPN or HP 3325

Procedure:

Note... The Adapter measures SAT deviation in a very narrow bandwidth centred on the SAT frequency. Independent filters of this characteristic are not generally available. Therefore, the test method is written around a good quality modulation meter with an internationally recognized filter bandwidth and noise averaging selected.

(1) Connect the LF generator output socket to the signal generator external modulation input socket and connect the signal generator output socket to the modulation meter input socket as shown in Fig. 5-3.

(2) Set the LF generator to give an output of 6 kHz at a level suitable for the signal generator being used.

(3) Set the signal generator to a frequency of 835.020 MHz (AMPS) or 898.0625 MHz (TACS), 2 kHz (AMPS) or 1.7 kHz (TACS) external deviation, RF level 13 dBm.

(4) Set the modulation meter to monitor FM in a 50 Hz to 15 kHz bandwidth with noise average selected.

(5) Note the deviation displayed on the modulation meter.

(6) Switch on the Adapter and press the CRTS key. When the equipment has completed its self-test, check that the correct system is selected (i.e. AMPS or TACS).

(7) Select MANUAL TEST.

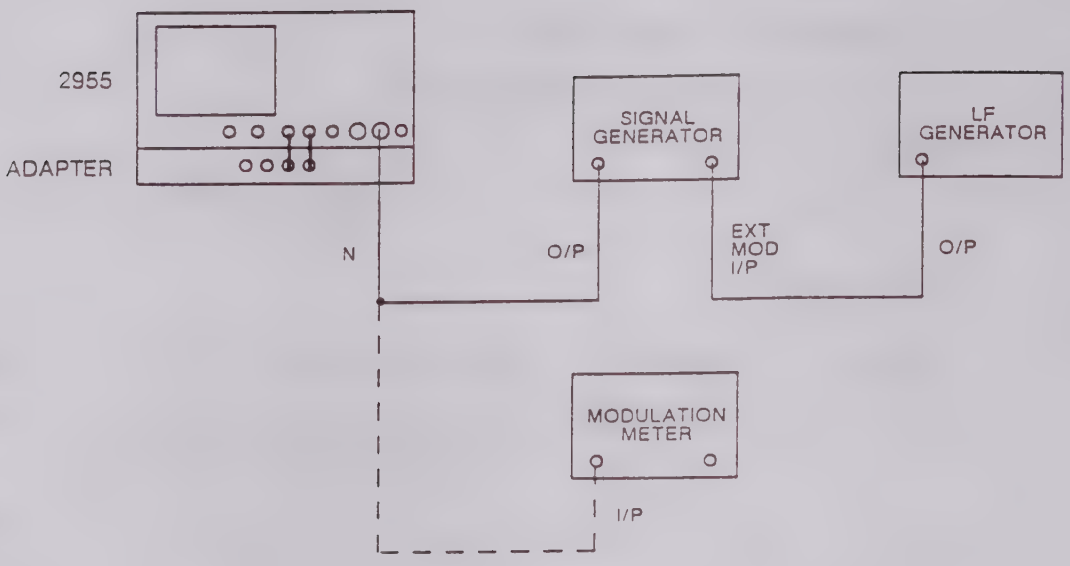

Fig. 5-3 Test equipment connections for SAT measurement test

(8) Set the channel to 323 and the mode to ~~FCC~~ DATA OFF.

(9) Using the CHANGE key and the data keypad, set the SAT generator frequency to the same frequency as that set on the LF generator. The CHANGE key should now have changed to NEXT and the flashing cursor should be under the SAT level.

(10) Press the NEXT key twice. The flashing cursor should disappear. (Although the SAT generator output is not actually used during this check, the SAT generator frequency has to be set always to the same frequency as that set on the LF generator in order to ensure that the correct internal calibration table is used.)

(11) Connect the signal generator output to the 2955 RF IN/OUT N socket.

(12) Check that SAT appears in reverse on the screen and that the SAT level displayed is within ±10% of the deviation noted on the modulation meter.

(13) Repeat for LF generator frequencies of 5.970 and 6.030 kHz.

PSOPHOMETRIC FILTER - CCITT

4. This test applies to NMT, TACS, RC2000 and Band III.

Specification:

CCITT response	50 Hz to 300 Hz	±2 dB.
	300 Hz to 800 Hz	±1 dB.
	800 Hz reference	±0 dB ±0.2 dB.
	800 Hz to 3 kHz	±1 dB.
	3 kHz to 3.5 kHz	±2 dB.
	3.5 kHz to 5 kHz	±3 dB.

Test equipment:

Reference	Description	Minimum specification	Example
e	Synthesized LF generator	50 Hz to 5 kHz, 2 V RMS	R & S SPN or HP 3325
f	DVM	AC: RMS accuracy <0.5%, DC volts: 1 MΩ, accuracy <0.5%	Solatron 7150+ or Datron 1065A

Procedure:

(1) Connect the LF synthesizer output socket to the Adapter's AF INPUT socket and connect the Adapter's AF OUT socket to the DVM input socket as shown in Fig. 5-4.

Note... As short a lead as possible should be used from the Adapter's AF OUTPUT to the DVM as a long lead can cause the output to oscillate. If this problem still occurs during the test, connect a 470 Ω resistor in series with the AF OUTPUT. This does not affect the results of the test.

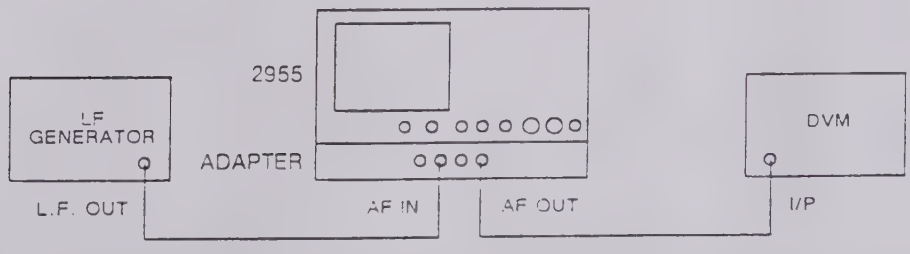

Fig. 5-4 Test equipment connections for psophometric filter test

(2) Switch on the equipment and check that the LED lights above the Adapter's 2955 key.

(3) Set the LF synthesizer to give an 800 Hz sinewave at 2 V RMS.

(4) Set the DVM to monitor AC voltage.

(5) Note the reading on the DVM (reading 1).

(6) Press the PSOH/LOCAL key and check that the LED above this key and that above the 2955 key are both on.

(7) Note the reading on the DVM (reading 2). This reading should be approximately 2 V. (If the reading is approximately 1.7 V, this indicates that AMPS is selected and the C-message filter is in circuit. When this is the case, then either go to the C-message filter check or enter the CRTS mode and select one of the systems mentioned above.)

(8) Check that reading 2 is within 6% of reading 1. If not, R149 on the personality board B4 requires adjustment.

(9) With the LF generator at 800 Hz, adjust the LF generator output level until the DVM reads 2.000 V. This sets the reference at 800 Hz.

(10) Set the LF generator to each of the frequencies given in Table 5-4 and check that the DVM readings fall within the limits given in the right-hand column.

TABLE 5-4 CCITT FILTER RESPONSE

Frequency	Nominal level		DVM limits	
Hz	dB	V (2 V in)	dB	V
150	-29	0.07096	-31 to -27	0.05637 to 0.08934
200	-21	0.17825	-23 to -19	0.14159 to 0.2244
300	-10.6	0.5902	-12.6 to -8.6	0.4688 to 0.7430
400	-6.3	0.9683	-7.3 to -5.3	0.863 to 1.0865
500	-3.6	1.3214	-4.6 to -2.6	1.1777 to 1.4826
600	-2.0	1.5887	-3.0 to -1.0	1.4159 to 1.7825
800	0	2.000	Reference	Reference
1000	+1.0	2.244	0.0 to +2.0	2.000 to 2.5179
1200	0.0	2.000	-1.0 to +1.0	1.7825 to 2.244
1500	-1.3	1.72199	-2.3 to -0.3	1.5347 to 1.9321
2000	-2.0	1.5887	-3.0 to -1.0	1.4159 to 1.7825
2500	-4.2	1.2332	-5.2 to -3.2	1.099 to 1.3837
3000	-5.6	1.0496	-7.6 to -3.6	0.8337 to 1.3214
3500	-8.5	0.7517	-10.5 to -6.5	0.5970 to 0.9463
4000	-15	0.35565	-18.0 to -12.0	0.2518 to 0.5024
5000	-36	0.0317	-39.0 to -33.0	0.02244 to 0.0448

PSOPHOMETRIC FILTER - C-MESSAGE

5. This test applies to AMPS only.

Specification:

C-message response	60 Hz	55.7 ±2 dB.
	100 Hz	42.5 ±2 dB.
	200 Hz	25.0 ±2 dB.
	300 Hz	16.5 ±1 dB.
	400 Hz	11.4 ±1 dB.
	500 Hz	7.5 ±1 dB.
	600 Hz	4.7 ±1 dB.
	700 Hz	2.7 ±1 dB.
	800 Hz	1.5 ±1 dB.
	900 Hz	0.6 ±1 dB.
	1 kHz	0 reference.
	1.2 kHz	0.2 ±1 dB.
	1.3 kHz	0.5 ±1 dB.
	1.5 kHz	1.0 ±1 dB.
	1.8 kHz	1.3 ±1 dB.
	2.0 kHz	1.3 ±1 dB.
	2.5 kHz	1.4 ±1 dB.
	2.8 kHz	1.9 ±1 dB.
	3.0 kHz	2.5 ±1 dB.
	3.3 kHz	5.2 ±2 dB.
	3.5 kHz	7.6 ±2 dB.
	4.0 kHz	14.5 ±3 dB.
	4.5 kHz	21.5 ±3 dB.
	5.0 kHz	28.5 ±3 dB.
	Attenuation to increase thereafter at 12 dB/octave up to 60 dB.	

Test equipment:

Reference	Description	Minimum specification	Example
e	Synthesized LF generator	50 Hz to 5 kHz, 2 V RMS	R & S SPN or HP 3325
f	DVM	AC: RMS accuracy <0.5%, DC volts: 1 MΩ, accuracy <0.5%	Solatron 7150+ or Datron 1065A

Procedure:

(1) Connect the LF synthesizer output socket to the Adapter's AF INPUT socket and connect the Adapter's AF OUT socket to the DVM input socket as shown in Fig. 5-5.

Note... As short a lead as possible should be used from the Adapter AF OUTPUT to the DVM as a long lead can cause the output to oscillate. If this problem still occurs during the test, connect a 470 Ω resistor in series with the AF OUTPUT. This does not affect the results of the test.

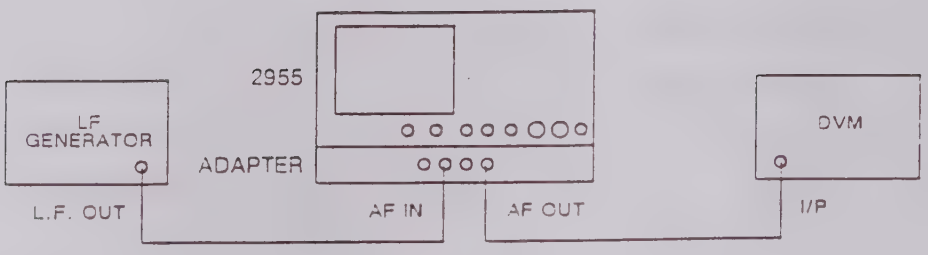

Fig. 5-5 Test equipment connections for psophometric filter test

(2) Switch on the equipment and check that the LED lights above the Adapter's 2955 key.

(3) Set the LF synthesizer to give a 1 kHz sinewave at 2 V RMS.

(4) Set the DVM to monitor AC voltage.

(5) Note the reading on the DVM (reading 1).

(6) Press the PSOH/LOCAL key and check that the LED above this key and that above the 2955 key are both on.

(7) Note the reading on the DVM (reading 2). This reading should be approximately 2 V. (If the reading is approximately 1.7 V, this indicates that a system other than AMPS is selected and the CCITT filter is in circuit. When this is the case, then either go to the CCITT filter check or enter the CRTS mode and select AMPS.

(8) Check that reading 2 is within 6% of reading 1. If not, R170 on the personality board B4 requires adjustment.

(9) With the LF generator at 1 kHz, adjust the LF generator output level until the DVM reads 2.000 V. This sets the reference at 1 kHz.

(10) Set the LF generator to each of the frequencies given in Table 5-5 and check that the DVM readings fall within the limits given in the right-hand column.

TABLE 5-5 C-MESSAGE FILTER RESPONSE

Frequency Hz	Nominal level dB	V (2 V in)	DVM limits dB	V
90	-44.3	0.01219	-46.3 to -42.3	0.00968 to 0.01535
200	-25	0.11247	-27.0 to -23.0	0.0893 to 0.1416
300	-16.5	0.29925	-17.5 to -15.5	0.2667 to 0.3358
400	-11.4	0.53831	-12.4 to -10.4	0.47946 to 0.60399
500	-7.5	0.84339	-8.5 to -6.5	0.7516 to 0.9463
600	-4.7	1.16421	-5.7 to -3.7	1.037 to 1.3063
700	-2.7	1.46565	-3.7 to -1.7	1.3063 to 1.6445
800	-1.5	1.68279	-2.5 to -0.5	1.4998 to 1.888
900	-0.6	1.86651	-1.6 to +0.4	1.6635 to 2.094
1000	0	2.0000	Reference	Reference
1200	-0.2	1.95447	-1.2 to +0.8	1.7419 to 2.193
1300	-0.5	1.88812	-1.5 to +0.5	1.4998 to 2.1185
1500	-1.0	1.7825	-2.0 to 0.0	1.5886 to 2.0000
1800	-1.3	1.72199	-2.3 to -0.3	1.5347 to 1.932
2000	-1.3	1.72199	-2.3 to -0.3	1.5347 to 1.932
2500	-1.4	1.70227	-2.4 to -0.4	1.517 to 1.91
2800	-1.9	1.70705	-2.9 to -0.9	1.432 to 1.803
3000	-2.5	1.49979	-3.5 to -1.5	1.336 to 1.683
3300	-5.2	1.09908	-7.2 to -3.2	0.873 to 1.384
3500	-7.6	0.83374	-9.6 to -5.6	0.662 to 1.0496
4000	-14.5	0.37673	-17.5 to -11.5	0.2667 to 0.532
4500	-21.5	0.16828	-24.5 to -18.5	0.119 to 0.2377
5000	-28.5	0.07516	-31.5 to -25.5	0.0532 to 0.1062

1200 BAUD FFSK GENERATOR

6. This test applies to NMT, RC2000 and Band III only. The modem is tested during the instrument self-test. This can be used as an independent check when required.

Specification:

FFSK (Phase continuous, frequency shifted tones of 1200 Hz and 1800 Hz) -

Deviation	±10% at 1 kHz to 4 kHz.
Data rate	1200 baud ±1 bit per second.

Test equipment:

Reference	Description	Minimum specification	Example
b	Counter/timer	Period measurement, ns range accuracy <±5 parts/10^6	Marconi 2437
c	Modulation meter	150 to 1000 MHz FM, noise averaging, LF output, measurement accuracy <2%	Marconi 2305

Procedure:

(1) Connect the 2955 RF IN/OUT N socket to the modulation meter RF input socket and connect the modulation meter LF output to the counter/timer input socket as shown in Fig. 5-6.

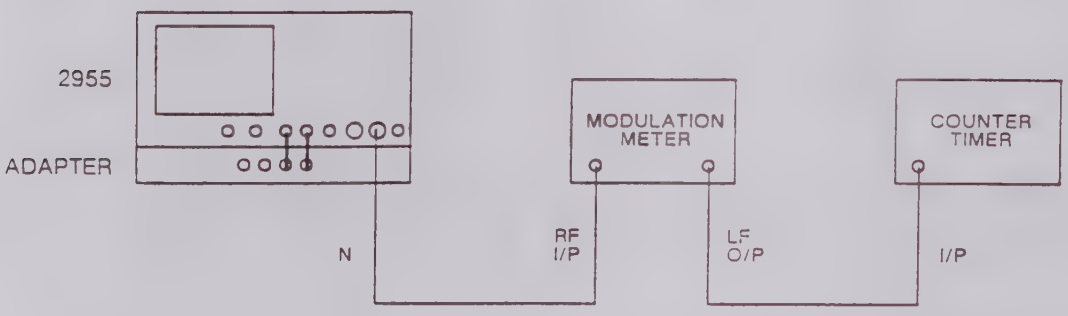

Fig. 5-6 Test equipment connections for 1200 baud FFSK generator test

(2) Switch on the Adapter on and press the CRTS key.

(3) When the Adapter has finished its self-test, check that the system selected is either NMT, RC2000 or Band III. If this is not the case, then select one of these systems before continuing.

(4) Select MANUAL TEST and the 1200 Hz mode. Set the data level to 3.5 kHz (NMT) or 1.5 kHz (Band III). For RC2000, set the FFSK TAUX to 1.5KHz.

(5) The data modulated carrier level has to be increased for it to trigger the modulation meter. To achieve this, press 2955 and then RX. If the 2955 key is inadvertently pressed twice, the data is switched off. (To recover, press CRTS, 2955 and RX).

(6) In this mode, the carrier frequency reverts to a default value. When it is required to check the data deviation on a particular channel, set the RF generator to the corresponding channel frequency.

(7) Set the modulation meter to monitor FM noise average in a 0.3 to 3.4 kHz bandwidth. Set the LF level potentiometer to the brown marker (2305).

(8) Set the counter/timer to measure period on the ns range. (This is required to achieve the correct accuracy and resolution.)

(9) Check on the modulation meter that the deviation displayed is within ±10% of that set.

(10) Check on the counter that the frequency indicated is 1200 Hz ±1Hz.

(11) Repeat with the mode set to 1800 Hz and then with the mode set to DOTTING (or DONNEES ALTERNEES for the RC2000). Note when the mode is set to dotting, the frequency on the counter appears as 1500 Hz. (To return to MANUAL mode, press the CRTS key.)

FSK AND MANCHESTER DATA GENERATOR

7. This test applies to AMPS and TACS only. The modem is tested during the instrument self-test. This can be used as an independent check when required.

Specification:

Manchester encoded NRZ data -

Deviation	±10% from 1 kHz to 10 kHz.
Data rate	± 1 bit per second at 10 kHz (AMPS) or 8 kHz (TACS).

Test equipment:

Reference	Description	Minimum specification	Example
b	Counter/timer	Period measurement, ns range accuracy <±5 parts/10^6	Marconi 2437
c	Modulation meter	150 to 1000 MHz FM, noise averaging, LF output, measurement accuracy <2%	Marconi 2305

Procedure:

(1) Connect the 2955 RF IN/OUT N socket to the modulation meter RF input socket and connect the modulation meter LF output to the counter/timer as shown in Fig. 5-7.

(2) Switch on the Adapter on and press the CRTS key.

(3) When the Adapter has finished its self-test, check that the system selected is AMPS or TACS. If this is not the case, then select one of these systems before continuing.

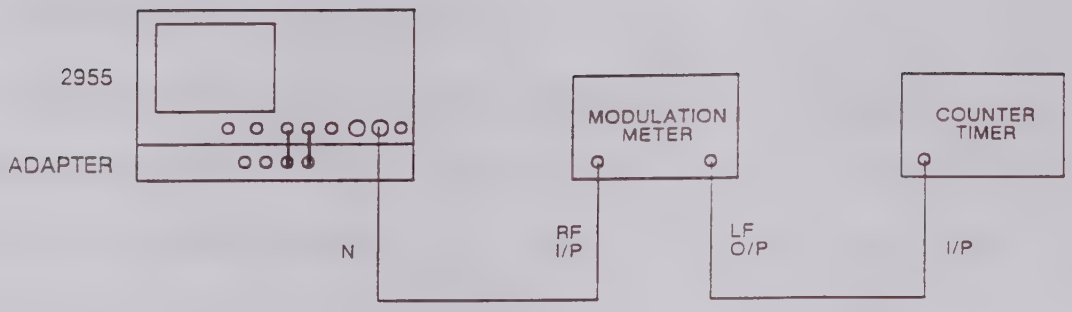

Fig. 5-7 Test equipment connections for FSK and Manchester data generator test

(4) Select MANUAL TEST and the signal tone mode. Set the data level to 8 kHz (AMPS) or 6.4 kHz (TACS).

(5) The data modulated carrier level has to be increased for it to trigger the modulation meter. To achieve this, press 2955 and then RX. If the 2955 key is inadvertently pressed twice, the data is switched off. (To recover, press CRTS, 2955 and RX).

(6) In this mode, the carrier frequency reverts to a default value. If it is required to check the data deviation on a particular channel, set the RF generator to the corresponding channel frequency.

(7) Set the modulation meter to monitor FM noise average in a 50 Hz to 15 kHz bandwidth. Set the LF level potentiometer to the brown marker (2305).

(8) Set the counter/timer to measure period on the ns range. (This is required to achieve the correct accuracy and resolution.)

(9) Check on the modulation meter that the deviation displayed is within ±10% of that set.

(10) Check on the counter that the frequency indicated is 100000 ns ±10 ns (AMPS) or 125000 ns ±16 ns (TACS).

INFRABAND DATA GENERATOR

8. This test applies to RC2000 only. The modem is tested during the instrument self-test. This can be used as an independent check when required.

Note... This is a functional check only. When the Infraband generator is calibrated during the instrument self-test, it is passed through a 150 Hz bandpass filter. As filters of this type are not generally available, the check is written around a good modulation meter using an internationally recgonised bandwidth.

Specification:

Sub-audible FSK NRZ data sent as asynchronous ASCII bytes -

Frequency	136 Hz and 164 Hz ±1 Hz.
Deviation	300 Hz to 1 KHz ±10%.

Test equipment:

Reference	Description	Minimum specification	Example
b	Counter/timer	Period measurement, ns range accuracy <±5 parts/10^6	Marconi 2437
c	Modulation meter	150 to 1000 MHz FM, noise averaging, LF output, measurement accuracy <2%	Marconi 2305

Procedure:

(1) Connect the 2955 RF IN/OUT N socket to the modulation meter RF input socket and connect the modulation meter LF output to the counter/timer input socket as shown in Fig. 5-8.

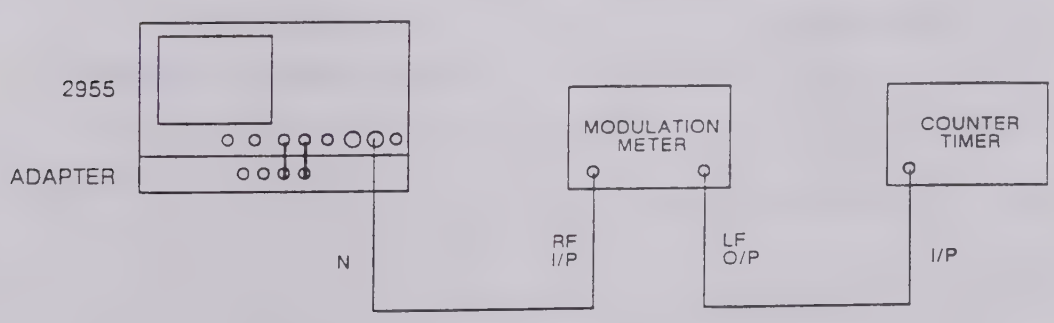

Fig. 5-8 Test equipment connections for infraband data generator test

(2) Switch on the Adapter and press the CRTS key.

(3) When the Adapter has finished its self-test, check that the system selected is RC2000. If this is not the case, then select this system before continuing.

(4) Select MANUAL TEST and set the mode to 136 Hz. Set the INFRA TAUX to 1 KHz.

(5) The data modulated carrier level has to be increased for it to trigger the modulation meter. To achieve this, press 2955 and then RX. If the 2955 key is inadvertently pressed twice, the data is switched off. (To recover, press CRTS, 2955 and RX.)

(6) In this mode, the carrier frequency reverts to a default value. When it is required to check the data deviation on a particular channel, set the RF generator to the corresponding channel frequency.

(7) Set the modulation meter to monitor FM noise average in a 50 Hz to 15 kHz bandwidth. Set the LF level potentiometer to the brown marker (2305).

(8) Set the counter/timer to measure period on the ns range. (This is required to achieve the correct accuracy and resolution.)

(9) Check on the modulation meter that the deviation displayed is within +20% -10% of that set.

(10) Check on the counter that the frequency indicated is within ±1 Hz.

(11) Repeat for the mode set to 164 Hz.

DC METER

9. These tests are for voltage, current and power measurement accuracy.

Specification:

Voltmeter	±5% ±100 mV at 1 to 25 V.
Ammeter	±5% ±200 mA at 0 to 10 A.
Power meter	±10% ±20 mW at 100 mW to 200 W.

Test equipment:

Reference	Description	Minimum specification	Example
f	DVM	DC volts: 1 MΩ, accuracy <0.5%	Solatron 7150+ or Datron 1065A
g	Rheostat	0 to 100 Ω. 10 A	Berco
h	DC power supply	0 to 25 V, 10 A	Farnell B30/10
j	DVM current shunt	10 A, 0.25% accuracy, sensitivity 10 mV/A	Fluke 80J-10

Procedure:

(1) Connect the DC power supply to the Adapter's DC IN connectors, connect the DVM to the same connectors and connect the rheostat across the Adapter's DC OUT connectors as shown in Fig. 5-9.

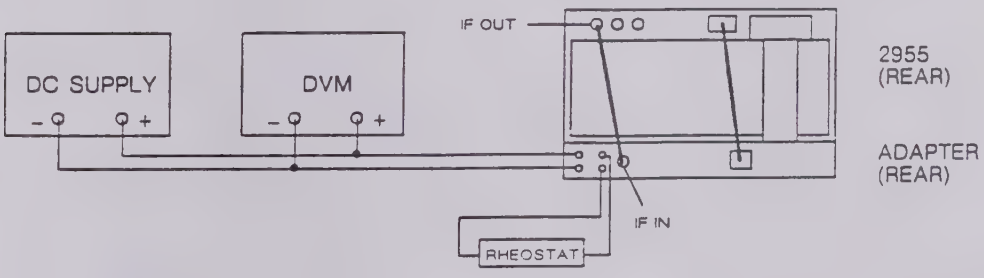

Fig. 5-9 Test equipment connections for DC meter test

(2) Switch on the equipment and press the CRTS key.

(3) When the instrument has completed its self-test, select MANUAL TEST.

(4) Adjust the rheostat to give a load resistance of 10 Ω.

(5) Set the DVM to read DC volts and then adjust the DC power supply to give a 10.00 V reading on the DVM.

(6) Check that the voltage displayed on the screen is within ±5% ±100 mV of the voltage indicated on the DVM.

(7) Check that the power reading displayed on the screen is equal to the current reading multiplied by the voltage reading.

(8) Repeat for voltages between 1 V and 25 V.

(9) Switch off the DC supply, disconnect the DVM and connect the current shunt across its inputs. Then reconnect the DVM in series with the positive supply as shown in Fig. 5-10.

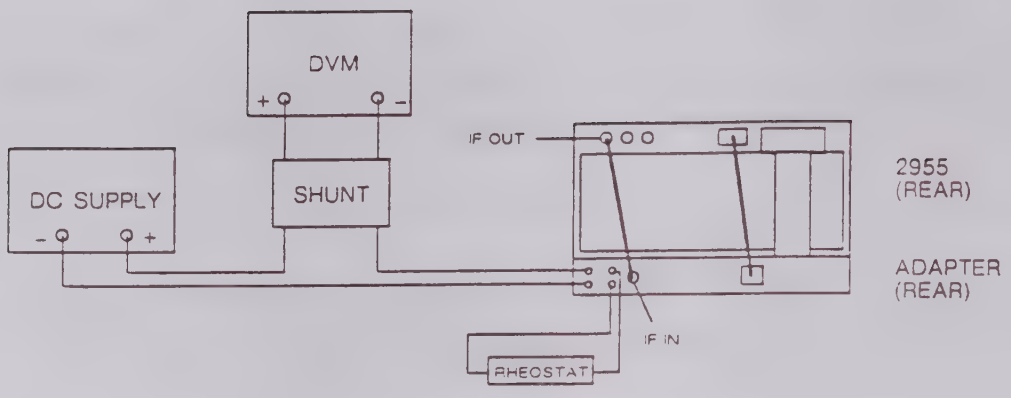

Fig. 5-10 Test equipment connections for DC meter test

(10) Set the rheostat to give a load resistance of 5 Ω.

(11) Set the DC power supply to give an output of 10 V and switch it on.

(12) Adjust the rheostat until the DVM indicates 20.0 mV (2 A).

(13) Check that the current reading displayed on the screen is within ±5% ± 200 mA of the current indicated on the DVM. (Every 10 mV displayed on the DVM is equivalent to 1 A.)

(14) Using the rheostat to adjust the current, repeat for DC levels on the DVM from 10 mV to 100 mV (1 A to 10 A).

EXTERNAL MODULATION

10. This test is for external modulation sensitivity.

Specification:

Sensitivity	0.5 V p-p for 5 kHz deviation ±10% at 1 kHz.

Test equipment:

Reference	Description	Minimum specification	Example
c	Modulation meter	300 Hz to 3.4 kHz filter, LF output, measurement accuracy <2%	Marconi 2305
e	Synthesized LF generator	1 kHz, 0.5 V pk-pk	R & S SPN or HP 3325
f	DVM	AC: RMS accuracy <0.5%,	Solatron 7150+ or Datron 1065A

Procedure:

(1) Connect the LF generator to the Adapter's EXT MOD INPUT socket and the DVM and connect the 2955 BNC RF IN/OUT socket to the modulation meter input socket as shown in Fig. 5-11.

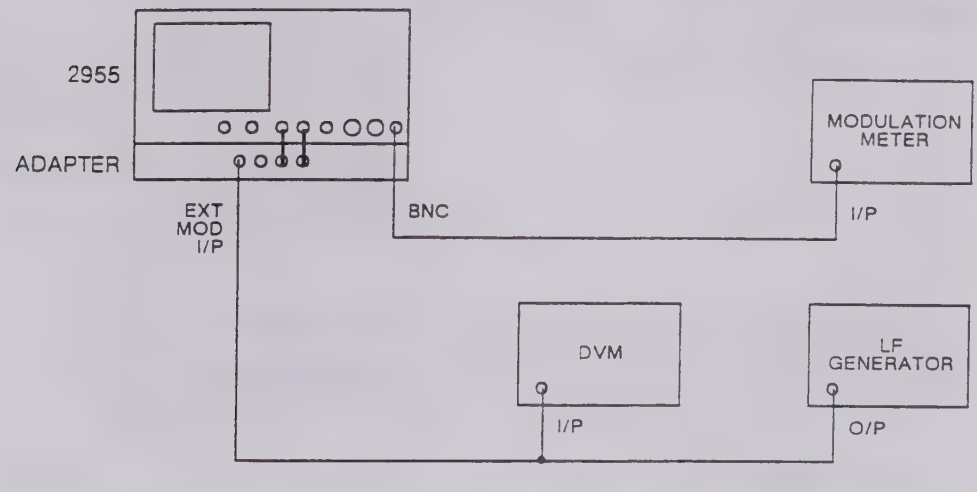

Fig. 5-11 Test equipment connections for external modulation test

(2) Switch on the equipment and check that the LED lights above the Adapter's 2955 key.

(3) Select RX mode and the RF IN/OUT BNC socket. Set the signal generator to a carrier frequency of 100 MHz, RF level to 0 dBm, modulation to 1 kHz, deviation level to 0 kHz, distortion to off and SINAD-S/N to off.

(4) Set the DVM to monitor AC volts RMS.

(5) Set the modulation meter to monitor FM with the 300 Hz to 3.4 kHz filter selected.

(6) Set the LF generator to give a 1 kHz sinewave output and adjust the level to give an RMS reading on the DVM of 176.7 mV.

(7) Check that the modulation meter reads 5 kHz deviation ±10%.

DISC DRIVE INTERFACE

11. The most convenient method of checking the performance of the disc drive interface is to ensure that a disc can be formatted correctly.

Specification:

Disc drive interface	Compatible with 3.5 or 5.25 inch, 40 or 80 track, single-sided or double-sided, single density disc drive with industry standard S.400 (Shugart) controller drive interface. Track to track stepping times of 6, 12, 20 and 30 ms are selectable.

Procedure:

(1) Insert a blank disc into the disc drive.

(2) Connect the disc drive to the DISC INTERFACE port on the right-hand side of the Adapter.

(3) Switch on the equipment.

(4) Press the DISC key to enter the DISC MENU. The Adapter attempts to read the disc directory. As the disc has not yet been formatted, DISC FAULT is displayed.

(5) Press the FORMAT key. The screen now displays DATA ON DISC WILL BE LOST PRESS ENTER TO CONFIRM.

(6) Press ENTER. When formatting has been completed, check that a catalogue of ten files is shown with NO FILE against each file.

SERIAL CONTROL PORT

12. In this test, two RF generator frequency settings (199 and 400 MHz) are checked by means of a program which is sent to the serial control port.

Specification:

Data rate	75 to 9600 baud.
Length	8 or 7.
Parity	Even, odd or none.
Stop bits	1 or 2.

Test equipment:

Reference	Description	Minimum specification	Example
k	Controller with serial interface	RS-232 compatible with selectable start, stop and parity	HP85 with serial interface

Procedure:

(1) Connect the RS-232 controller to the Adapter's SERIAL PORT.

(2) Enter the SERIAL INTERFACE MENU and set a BAUD RATE of 4800, LENGTH/PARITY to 8/EVEN and STOP BITS to 2.

(3) Enter and run a program which sets the 2955 RF generator to a specific frequency and then reads back the RF generator frequency to check that the command has been accepted and carried out. As an example, the following program is in HP-BASIC for an HP85 GPIB Controller:-

```
 10 RESET 10                                  Resets controller serial
                                              control port.
 20 SET TIMEOUT 10;5000
 30 ON TIMEOUT 10 GOTO 330                    If any of the input/output
                                              commands take more than 5 s
                                              to complete (e.g. due to
                                              problem with controller
                                              connector or Adapter),
                                              program pauses and indicates
                                              a timeout has taken place.
 40 CONTROL 10,3 ; 13,31,0                    Sets up controller serial
                                              port for 4800 baud rate,
                                              8-bit word length, even
                                              parity, 2 stop bits.
 50 WAIT 500
 60 OUTPUT 10 "CRTS" @ WAIT 1000              Commands Adapter to go into
                                              CRTS mode.
 70 OUTPUT 10 "RD1"
 80 ENTER 10 ; R$                             Performs a read command on
                                              the Adapter's serial buffer
                                              (to ensure that the buffer is
                                              empty).
 90 CLEAR @ DISP "SETTING 400MHz FREQUENCY"   Clears controller screen and
                                              then displays SETTING 400 MHz
                                              FREQUENCY.
100 OUTPUT 10 "COM RGFR400MZ"                 Commands Adapter to set an RF
                                              generator frequency of
                                              400 MHz.
110 OUTPUT 10 "NO"                            Sets Adapter into 2955 mode
                                              so that RF generator
                                              frequency can be seen on 2955
                                              screen.
120 WAIT 5000                                 Program halts for 5 s.
130 OUTPUT 10 "CRTS"                          Commands Adapter back to CRTS
                                              mode.
```

```
140 OUTPUT 10 "RD27"                                  Commands Adapter to put its
                                                      RF generator frequency
                                                      setting into its serial
                                                      output buffer.
150 ENTER 10 ; R$                                     Reads Adapter buffer.
155 R$=R$[1,12]
160 DISP
170 DISP "SET 400MHz ; READ ";R$                      On controller screen,
                                                      displays RF generator
                                                      frequency set and RF
                                                      generator frequency read.
180 P=1 @ IF R$ <> "400.00000MHz" THEN P=0            Compares frequency set with
                                                      frequency read.  If not the
                                                      same, pass/fail flag is set
                                                      to fail.
190 DISP @ DISP "SETTING 199MHz FREQUENCY"            190 to 290 same as 90 to 180
200 OUTPUT 10 "COM RGFR199MZ"                         except frequency is 199 MHz.
210 OUTPUT 10 "NO"
220 WAIT 5000
230 OUTPUT 10 "CRTS"
240 OUTPUT 10 "RD27"
250 ENTER 10 ; R$
255 R$=R$[1,12]
260 DISP
270 DISP "SET 199MHz ; READ ";R$
280 IF R$<> "199.00000MHz" THEN P = 0
290 IF P=1 THEN P$ = "Passed" ELSE P$ = "Failed"
300 BEEP 20,100 @ WAIT 100 @ BEEP 20,100             Audio indication from
                                                      controller to inform test is
                                                      complete.
310 DISP @ DISP "TEST" ; P$                           Displays on controller screen
                                                      TEST PASSED or TEST FAILED
                                                      depending on pass/fail flag.
320 END                                               End of program.
330 DISP "TIMEOUT" @ BEEP @ PAUSE
```

PARALLEL CONTROL PORT

13. In this test, the data accuracy is checked by means of a program which is used to read and write to and from the parallel control port.

Specification:

Parallel control port	Centronics type 8 way bi-directional port. 4 TTL outputs (unprotected). 4 TTL inputs (unprotected). +5 V DC supply at 100 mA accessory power (unprotected).

Test equipment:

Reference	Description	Minimum specification	Example
m	Oscilloscope	DC to 5 V display	Tektronix 2235
n	GPIB controller	GPIB output port	HP85 with GPIB or 82937A

Procedure:

(1) Connect the GPIB controller to the public GPIB socket on the rear of the Adapter.

(2) Enter the GPIB INTERFACE MENU. Set the PUBLIC GPIB ADDRESS to 06 and the GPIB function to TALKER/LISTENER.

(3) Prepare a terminator as shown in Fig. 5-12. This is to be used as instructed on the controller display during the program. The terminator should not be used until asked for as the first checks would fail.

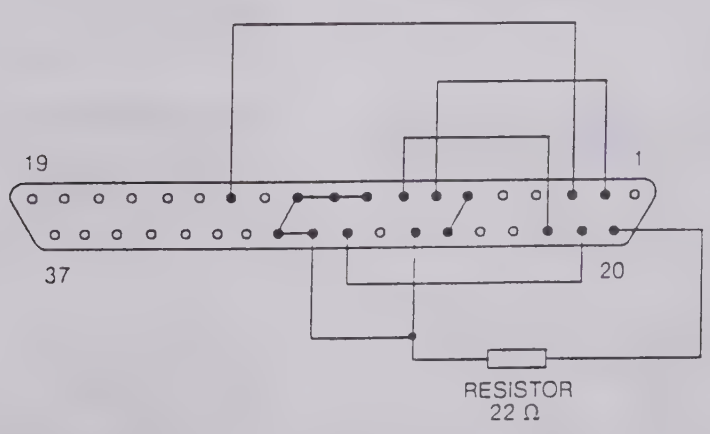

Fig. 5-12 Terminator connections for parallel control port test

(4) To enable the parallel control port to be written to and read from, either a GPIB or RS232C controller is required. The control program can then be either loaded as a user-defined program and stored on disc, if required, or the controller can directly command the parallel port. As an example, the following program is for an HP 85 GPIB Controller to directly control the port:-

```
 10 PRINT "PARALLEL PORT CHECKS"
 20 PRINT "=====================" 
 30 PRINT
 40 OUTPUT 706 ;"POI96,64"

 50 WAIT 1000
 60 OUTPUT 706 ;"POI88,255"
 70 CLEAR
 80 DISP "BI-DIRECTIONAL PORT
    OUTPUT CHECK";
 90 DISP ;"-----------------
    -----------";
100 DISP
110 DISP ;" USE THE OSCILLOSCOPE
    TO CHECK CONNECTOR PINS 6,
    9,10,11,25,26,29,30 ARE ALL
    LOW";
120 DISP ;"WITH RESPECT TO GROUND
    PIN 27"
130 DISP
140 DISP "CHECK FOR 5 VOLTS BETWEEN
    THE SUPPLY OUT PIN 1 AND
    GROUND PIN 27"
150 DISP
160 DISP "PRESS <CONT> WHEN READY"
170 BEEP @ PAUSE
180 CLEAR
190 DISP "BI-DIRECTIONAL PORT OUTPUT
    CHECK";
200 DISP "-------------------------
    -----"
210 DISP
220 DISP "USE THE OSCILLOSCOPE
    TO CHECK CONNECTOR PINS 6,9,
    10,11,25,26,29,30 ARE ALL
    HIGH"
230 DISP "WITH RESPECT TO GROUND
    PIN 27"
240 DISP
250 DISP "PRESS <CONT> WHEN READY"
260 OUTPUT 706 ;"POI88,000"
270 BEEP @ PAUSE
280 GOSUB 800
290 IF A$="000" THEN LET H$="PASSED"
300 IF A$<>"000" THEN LET H$="FAILED"
    @ BEEP 500,50 @ BEEP 800,50
310 CLEAR
320 DISP "BI-DIRECTIONAL PORT INPUT
    CHECK";
330 DISP "-------------------------
    ------"
```

First, 8-bit bidirectional port is checked.

Sets bi-directional port to output data mode.

Sets all 8 bits low (inverted).

User is asked to check for a low on each line using oscilloscope.

User is asked to check for +5 V.

User is asked to check that all lines are high. This checks that the port can output data correctly.

Sets all port lines high (inverted.)

Bi-directional port is checked to ensure that it reads data correctly. With nothing connected to the control lines, they float high. Controller reads port and ensures that result is 000 (inverted).

```
340 DISP
350 PRINT "BI-DIRECTIONAL PORT"
360 PRINT @ PRINT" SET READ
    PASS/FAIL"
370 PRINT "-----------------------
    ---------"
380 A1$="000"
390 PRINT USING 400 ; A1$,A$,H$
400 IMAGE XX,3A,6X,3A,8X,6A
410 DISP "CONNECT A CONNECTOR
    CONFIGURED AS IN DIAGRAM TO THE
    PARALLEL CONTROL PORT."
420 DISP
430 DISP "PRESS <CONT> WHEN READY"
440 BEEP @ PAUSE
450 GOSUB 800
460 IF A$="255" THEN H$="PASSED"
    ELSE H$="FAILED" @ BEEP 500,
    50 @ BEEP 800,50
470 CLEAR
480 DISP "BI-DIRECTIONAL PORT INPUT
    CHECK";
490 DISP; "-----------------------
    -----";
500 DISP
510 A1$="255"
520 PRINT USING 400; A1$,A$,H$
530 DISP
540 PRINT
550 T=0
560 T$="0"
570 CLEAR
580 DISP "TTL CONTROL CHECK"
590 OUTPUT 706 ;"POI96,255"
600 WAIT 200
610 GOSUB 890
620 PRINT "TTL CHECK HIGH";
630 IF T=255 THEN PRINT "PASSED"
    ELSE PRINT "FAILED" @ BEEP
    500,50 @ BEEP 800,50
640 PRINT
650 OUTPUT 706 ;"POI96,000"
660 GOSUB 890
670 PRINT "TTL CHECK LOW";
680 IF T=16 THEN PRINT "PASSED"
    ELSE PRINT "FAILED" @ BEEP 500,
    50 @ BEEP 800,50
690 PRINT
700 CLEAR
710 PRINT
720 PRINT "       TEST COMPLETE
    "
730 BEEP @ BEEP
740 DISP " TEST COMPLETE REMOVE
    CONNECTOR"
750 FOR X=1 TO 5
760 PRINT
770 NEXT X
```

User is asked to connect a terminator to the parallel control port. This pulls the 8 bi-directional port lines low. Also, 4 TTL outputs are routed to 4 TTL inputs.

Controller reads port and ensures that result is 255.

Sets the four TTL output lines high.

Controller reads 4 TTL inputs and checks result.

Sets the four TTL output lines low. Controller reads 4 TTL inputs and checks result.

```
780 LOCAL 706
790 END
800 FOR X=1 TO 3
810 OUTPUT 706 "POI96,16" @ OUTPUT
    706 "POI96,80"
820 OUTPUT 706 "PEI88"
830 WAIT 200
840 ENTER 706 ; R$
850 WAIT 200
860 IF X=3 THEN LET A$=R$
870 NEXT X

880 RETURN
890 ! TTL IN/OUT CHECK
900 FOR X=1 TO 3
910 WAIT 200
920 OUTPUT 706 ;"PEI96"
930 WAIT 200
940 ENTER 706 ; T$
950 IF X=1 OR X=2 THEN GOTO 970
960 LET T=VAL(T$)
970 NEXT X

980 RETURN
990 END
```

Sets the bi-directional port to read data.

Reads the result of the bi-directional post (3 times to obtain correct result).

Reads the result of the four TTL inputs.

Chapter 5-2

ADJUSTMENT AND CALIBRATION

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9	SAT filter adjustments - NMT	
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11	Clock recovery PLL - AMPS and TACS	
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INTRODUCTION

1. This chapter describes adjustments to restore the Adapter to its peak operating condition. Test equipment which is recommended for this purpose is listed in Chap. 5-0. Before carrying out any adjustment procedures, refer to Chap. 5-0 for safety considerations and access instructions.

2. Procedures are described for each board and are listed in board alpha-numeric order. When it is known that re-adjustment is needed on just one or two boards, it is normally sufficient to confine activities to those boards alone. If extensive re-adjustment or re-calibration is needed, the complete set of procedures should be carried out in the order given below.

ORDER OF ADJUSTMENTS

3. Adjustments have to be made in the following order:-

Adjustment	Board	Component	Preliminary adjustment required
+5 V power supply	A7	R23	None
Microprocessor clock	A1	C30	R23 on A7
SAT generator level	A1	R41	R23 on A7
FM demodulator DC offset	A1	R61	R23 on A7
Nominal demodulator level	A1	R73	R23 on A7, R61 on A1
DC power meter	A1	R82	R23 on A7
SAT filters -			
NMT	B4	R50	R23 on A7
AMPS and TACS	B4	R66	R23 on A7
Clock recovery PLL -			
AMPS	B4	R34	R23 on A7
TACS	B4	R33	R23 on A7, R34 on B4
Psophometric filter gain -			
CCITT	B4	R149	R23 on A7
C-message	B4	R170	R23 on A7

+5 V POWER SUPPLY

4. Proceed as follows:-

(1) Connect a DVM, set to DC V, across pin 1 (0 V) and pin 3 (+5 V) of the connector PLJ on the motherboard A1.

(2) Adjust R23 on the power supply board A7 for a DVM reading of 5.0 V.

MICROPROCESSOR CLOCK

5. Proceed as follows:-

(1) Connect an external reference frequency of better than 1 part/10^6 to a frequency counter. Connect a X1 oscilloscope probe between the frequency counter and pin 37 of IC1 on the motherboard A1.

(2) Switch on the equipment and allow a minimum of 5 minutes for the instruments to reach normal operating temperature.

(3) Adjust C30 for a reading on the frequency counter of 3.84 MHz ±60 Hz.

SAT GENERATOR LEVEL

6. This adjustment should be made immediately after the CRTS initializing when the power is switched on. This ensures that the instrument is set up for the adjustment. Proceed as follows:-

(1) Connect a DVM, set to AC V, across pin 4 of IC28 and ground on the motherboard A1.

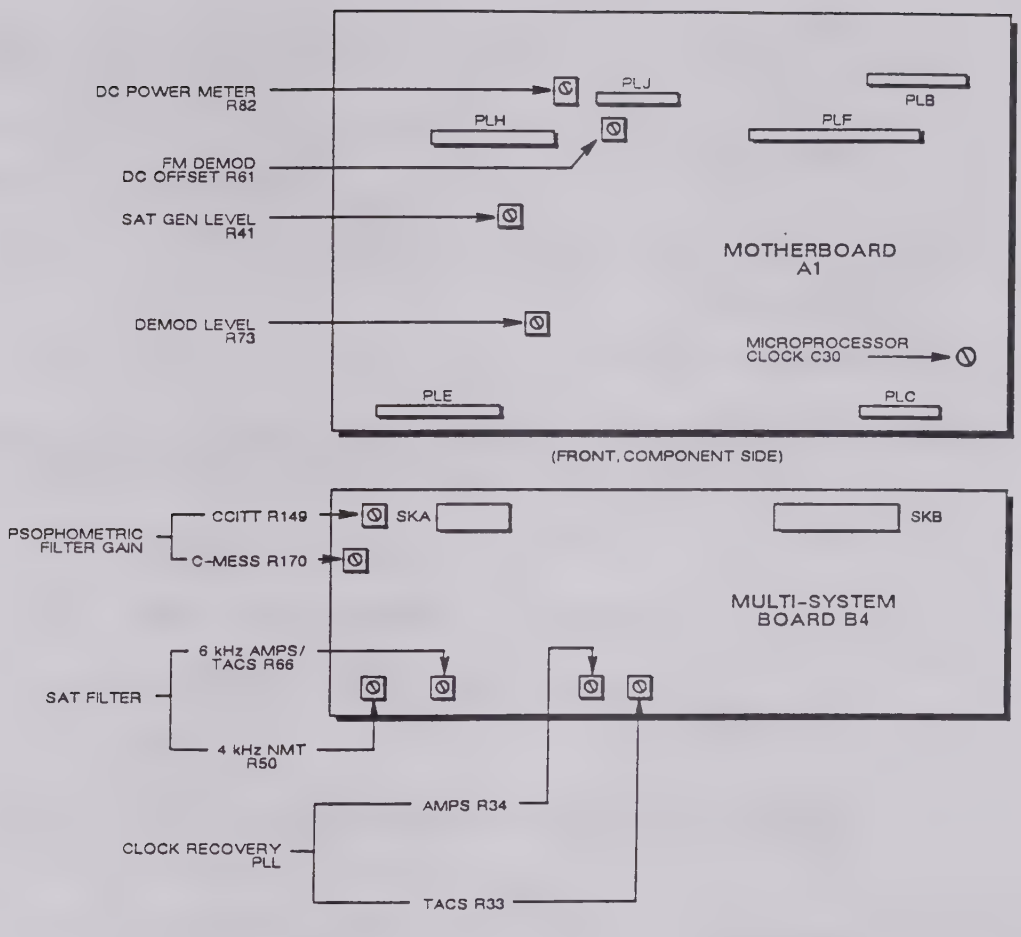

Fig. 5-13 Location of adjustment points

(2) Adjust R41 for a reading of 414 mV RMS (for initializing in other than Band III) or 177 mV RMS (for initializing in Band III) on the DVM.

FM DEMODULATOR DC OFFSET AND NOMINAL DEMODULATOR LEVEL

7. The signals required to set up the two presets in the FM demodulator circuits can be derived from the 2955 as follows:-

(1) Switch the equipment off, disconnect the IF lead between the 2955 and the Adapter and switch on the equipment.

(2) Connect a DVM, set to measure DC V, between IC49 pin 8 on the motherboard A1 and ground.

(3) Make a note of the reading and reconnect the IF lead.

(4) Press the HELP key on the 2955 followed by CHANGE PARAMETERS and TX. The screen should indicate that the 2955 is in self-test mode.

(5) Press the NEXT TEST key and wait until test 1.0 is completed. Adjust R61 to give the same reading as that taken in (4).

(6) Use NEXT TEST to step through the self-test until 3.1 is complete.

(7) Connect the DVM, set to AC V, between IC49 pin 7 and ground.

(8) Adjust R73 on the motherboard A1 to obtain 0.707 ±0.003 V on the DVM.

DC POWER METER

8. Proceed as follows:-

(1) Connect a DC power supply to the Adapter's DC IN connectors. Connect a DVM, with a current shunt across its inputs, in series with the positive supply. Connect a rheostat across the DC OUT connectors.

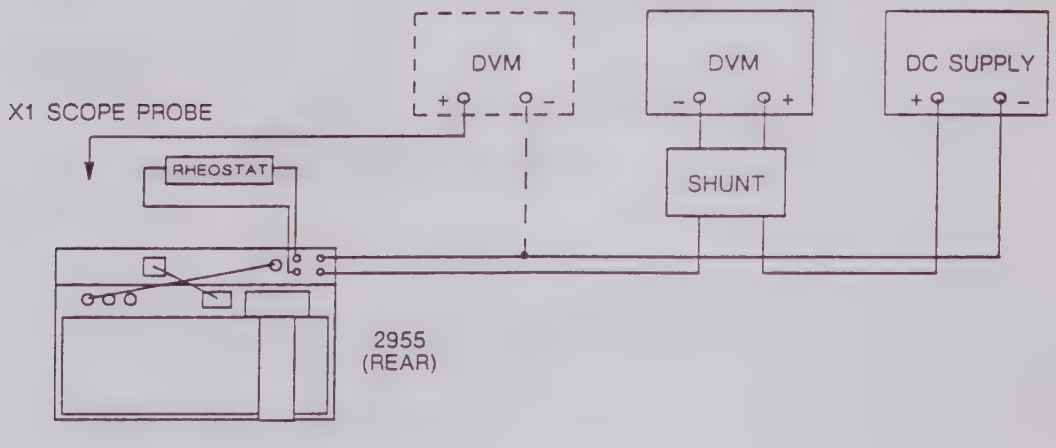

Fig. 3-14 Test equipment connections for DC power meter adjustment

(2) Set the DVM to measure DC V.

(3) Set the rheostat to give a load resistance of 5 Ω.

(4) Set the DC power supply to give an output of 15 V and switch on.

(5) Adjust the rheostat until the DVM indicates 50.0 mV (5 A). Note the exact reading (reading 1).

(6) Leave the current shunt in place in the positive supply but remove the DVM. Connect a X1 oscilloscope probe between the DVM and IC55 pin 6 on the motherboard A1.

(7) Adjust R82 on the motherboard A1 for a voltage indication on the DVM of 10 times that of reading 1 ±0.5%.

SAT FILTER ADJUSTMENTS - NMT

9. Proceed as follows:-

   (1) With the equipment switched off, remove the connector PLH.

   (2) Switch on the equipment.

   (3) Set the 2955 to AUDIO TEST and set an AF generator frequency of 4 kHz at a level of 177 mV. Select the 50 kHz lowpass filter and AC coupled.

   (4) Connect a X1 oscilloscope probe between the 2955 AF GEN OUTPUT to TP1 on the personality board B4.

   (5) Connect another X1 oscilloscope probe between the 2955 AF INPUT to TP7 on the personality board B4.

   (6) Adjust R50 on the personality board B4 for a maximum reading on the 2955 AF voltmeter.

   (7) Switch off the equipment and reconnect connector PLH.

SAT FILTER ADJUSTMENTS - AMPS AND TACS

10. Proceed as follows:-

   (1) With the equipment switched off, remove the connector PLH.

   (2) Switch on the equipment.

   (3) Set the 2955 to AUDIO TEST and set an AF generator frequency of 6 kHz at a level of 707 mV. Select the 50 kHz lowpass filter and AC coupled.

   (4) Connect a X1 oscilloscope probe between the 2955 AF GEN OUTPUT to TP1 on the personality board B4.

   (5) Connect another X1 oscilloscope probe between the 2955 AF INPUT to TP8 on the personality board B4.

   (6) Adjust R66 on the personality board B4 for a maximum reading on the 2955 AF voltmeter.

   (7) Switch off the equipment and reconnect connector PLH.

CLOCK RECOVERY PLL - AMPS AND TACS

11. The adjustment of R34 for AMPS affects the adjustment of R33 for TACS. Therefore, R34 should always be set up first.

12. To adjust R34 for AMPS only or for AMPS and TACS, proceed as follows:-

(1) With the equipment switched off, remove the connector PLH.

(2) Switch on the equipment and enter CRTS mode. Select AMPS.

(3) Select MANUAL TEST and FCC mode. Press the 2955, RX and AF GEN keys. The equipment should now be in AUDIO TEST mode with both the 2955 and CRTS LEDs on.

(4) Connect a X1 oscilloscope probe from the 2955 AF GEN OUTPUT to TP1 on the personality board B4.

(5) Set the AF generator to give a 10 kHz signal at 700 mV.

(6) Monitor TP4 on the personality board B4 with an oscilloscope (DC coupled, 10 ms/div timebase).

(7) Adjust R34 for a DC level of + 2.5V. When adjusted correctly, this should be a DC level with a small amount of noise (approximately 300mV) - it should not be a pulse.

(8) Switch off the equipment and reconnect connector PLH.

13. To adjust R33 for TACS when both AMPS and TACS are fitted, proceed as follows:-

(1) With the equipment switched off, remove the connector PLH.

(2) Switch on the equipment and enter CRTS mode. Select TACS.

(3) Select MANUAL TEST and FCC mode. Press the 2955, RX and AF GEN keys. The equipment should now be in AUDIO TEST mode with both 2955 and CRTS LEDs on.

(4) Connect a X1 oscilloscope probe from the 2955 AF GEN OUTPUT to TP1 on the personality board B4.

(5) Set the AF generator to give a 8 kHz signal at 700 mV.

(6) Monitor TP4 on the personality board B4 with an oscilloscope (DC coupled, 10 ms/div timebase).

(7) Adjust R33 for a DC level of +2.5 V. When adjusted correctly, this should be a DC level with a small amount of noise (approximately 300 mV - it should not be a pulse.

(8) Switch off the equipment and reconnect connector PLH.

14. To adjust R34 and R33 for TACS only, proceed as follows:-

(1) With the equipment switched off, remove the connector PLH.

(2) Switch on the equipment and enter CRTS mode. When necessary, select TACS.

(3) Select MANUAL TEST and FCC mode. Press the 2955, RX and AF GEN keys. The equipment should now be in AUDIO TEST mode with both the 2955 and CRTS LEDs on.

(4) Connect a X1 oscilloscope probe from the 2955 AF GEN OUTPUT to TP1 on the personality board B4.

(5) Set R33 fully clockwise. (This has the same affect as if switch IC24d were closed as would be the case if AMPS were selected.)

(6) Set the AF generator to give a 10 kHz signal at 700mV.

(7) Monitor TP4 on the personality board B4 with an oscilloscope (DC coupled, 10 ms/div timebase).

(8) Adjust R34 for a DC level of + 2.5V. When adjusted correctly, this should be a DC level with a small amount of noise (approximately 300mV) - it should not be a pulse.

(9) Set the AF generator to give a 8 kHz signal at 700mV.

(10) Adjust R33 for a DC level of + 2.5V. When adjusted correctly, this should be a DC level with a small amount of noise (approximately 300mV) - it should not be a pulse.

PSOPHOMETRIC FILTER GAIN - CCITT

15. To adjust R149 for NMT, TACS, RC2000 and Band III, proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-test is complete, select one of the above systems.

(2) Return to 2955 mode by pressing the 2955 key twice and then press RX and AF GEN to select AUDIO TEST mode.

(3) Set the 2955 AF generator to a frequency of 800 Hz and a level of 2 V. Select the 50 kHz lowpass filter and AC coupling.

(4) Connect the 2955 AF GEN OUTPUT to the Adapter's AF INPUT. Connect the Adapter's AF OUTPUT to the 2955 AF INPUT.

(5) Note the reading on the 2955 AF voltmeter.

(6) Press the PSOPH/LOCAL key on the Adapter. The LED above this key should light indicating that the filter is in circuit.

(7) Adjust R149 for the same reading on the 2955 AF voltmeter as was noted in (5).

PSOPHOMETRIC FILTER GAIN - C-MESSAGE

16. To adjust R170 for AMPS, proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-test is complete, select AMPS.

(2) Return to 2955 mode by pressing the 2955 key twice and then press RX and AF GEN to select AUDIO TEST mode.

(3) Set the 2955 AF generator to a frequency of 1 kHz and a level of 2V. Select the 50 kHz lowpass filter and AC coupling.

(4) Connect the 2955 AF GEN OUTPUT to the Adapter's AF INPUT. Connect the Adapter's AF OUTPUT to the 2955 AF INPUT.

(5) Note the reading on the 2955 AF voltmeter.

(6) Press the PSOPH/LOCAL key on the Adapter. The LED above this key should light indicating that the filter is in circuit.

(7) Adjust R170 for the same reading on the 2955 AF voltmeter as was noted in (5).

Chapter 5-3

FAULT-FINDING

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40	DTMF tone output - AMPS, TACS and RC2000
41	Clock for modem LPF IC12 - All systems
42	DTMF tone path - AMPS, TACS and RC2000
43	DTMF receiver - AMPS, TACS and RC2000
44	50 baud FSK modem 150 Hz bandpass filter - RC2000
	1200 baud FFSK modem - NMT, RC2000 and band III
45	NMT
46	RC2000
47	Band III
	FSK and Manchester modem - AMPS and TACS
48	AMPS
49	TACS

50 Power supply board A4
51 +12 V absent
52 -12 V absent
53 +5 V absent
AC/DC power supply board A7
54 Transformer secondary
55 Diode bridge D1 to D4 and relay RLA
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57 Switch mode controller output and switching FETs
58 Transformer T1, rectifiers and smoothing

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5-18 Waveform at IC49 pin 1 12
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5-20 Waveform at IC14 pin 9 and D5 cathode 17
5-21 Waveform at IC39 pin 16 and IC39 pin 15 17
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5-29 Waveform at D13 cathode 34

MOTHERBOARD A1

1. The following sections describe the procedures for finding a fault on the motherboard as indicated by either the front panel LEDs or the CRTS self-test and system calibration.

VOLATILE RAM

2. When power is first applied to the Adapter, the microprocessor performs an all ones then all zeros read and write test throughout the volatile RAM IC58. A volatile RAM failure is indicated by all the LEDs flashing. If a failure occurs, proceed as follows:-

(1) Check all the tracks to and from IC58 for continuity.

(2) Check the pins on IC58 with an oscilloscope for non-toggling or peculiar voltage levels and, if present, ascertain whether they arise within the IC or elsewhere.

(3) Ensure that IC58 is being selected by monitoring IC 6 pin 10 which toggles low when IC58 is selected.

(4) If all these checks do not indicate the failure of anything other than IC58, then replace it with a spare.

NON-VOLATILE RAM

3. When power is first applied to the Adapter, the microprocessor performs a check sum on the non-volatile RAM which contains user-defined test data. A failure is indicated by the DISC LED flashing. Pressing any Adapter key informs the microprocessor that the operator is aware of the problem and sets a flag so that a later part of the software re-initializes the non-volatile RAM with default parameters. If a failure occurs, proceed as follows:-

(1) The most likely failure in this area is the lithium battery BT1. Check the voltage with the battery in circuit and the AC power off. If it reads less than 3 V, replace the battery.

WARNING Before any attempt is made to remove BT1, remove the isolating link LK4. Then replace BT1 and then reconnect LK4. This is to reduce the possibility of a dangerous short circuit.

(2) If the battery is good, with AC power off, monitor the voltage at IC11 pin 28 using an oscilloscope. It should give a reading of approximately 2.4 V DC. If it does not, then D4, R13 or the continuity between the battery and IC11 is suspect.

(3) With AC power on, monitor the voltage at IC11 pin 28 using an oscilloscope. If it does not read 5 V DC, then one of the components R84, D7, C2, D3 or C6 or the circuit continuity is defective.

(4) Check all the tracks to and from IC11 for continuity.

(5) Check the pins on IC11 with an oscilloscope for non-toggling or peculiar voltage levels and, if present, ascertain whether they arise within the IC or elsewhere.

(6) Ensure that IC11 is being selected by monitoring IC6 pin 12 which toggles low when IC11 is selected.

(7) Ensure IC11 is not being disabled by the power fail detector IC57. Check that IC11 pin 26 (chip enable 2) is high. If it is logic low, check that the +5 V DC is not low. If this is below +5 V, increase its level by following the procedure given in Chap. 5-2, para. 5.

(8) If IC57 pins 2, 8 and 9 are high and the +5 V DC is correct but pin 5 is low, then suspect IC57.

(9) If all these checks do not indicate the failure of anything other than IC11, then replace it with a spare.

ROM

4. The failure of ROM IC7 or IC8 is catastrophic and causes the CRTS LED to flash and prevent any further activity taking place. If a failure occurs, proceed as follows:-

(1) IC7 and IC8 are pluggable and it is possible that a bad contact exists between the IC and the IC holder. One at a time, to avoid confusing them, remove each IC from its holder and check for bent or broken pins. With great care, replace them in the holders ensuring that they are located the right way round and no pins become bent during replacement. Once they are firmly reseated, attempt to power up the Adapter again.

(2) If the CRTS LED still flashes, then check with an oscilloscope that the ROMs each have +5 V on pin 28.

(3) Check all the tracks to and from the ROMs for continuity.

(4) Check the pins on IC7 and IC8 with an oscilloscope for non-toggling or peculiar voltage levels and, if present, ascertain whether they arise within the ICs or elsewhere.

(5) Ensure that IC7 and IC8 are being selected by monitoring IC6 pins 4 and 5 which toggle low when IC7 and IC8 respectively are selected.

(6) If all these checks do not indicate the failure of anything other than IC7 or IC8, then replace them with a new pair. Both have to be changed. Ensure that the replacements are of the correct software level and are compatible.

GPIB INTERFACE

5. Failure of the internal GPIB interface is indicated by the 2955 LED flashing after completion of the self-test routine or, after CRTS mode has been selected, the CRTS LED flashing. If a failure occurs, proceed as follows:-

(1) Check that the 2955 is not in talk only mode and is set to a valid address.

(2) Check that the GPIB connectors are properly seated and that the cables are intact and free from damage.

(3) If a known good 2955 is available, substitute it for the one in use and determine whether the fault lies in the Adapter or the 2955. A similar step may be taken using a known good Adapter.

6. If the problem is on the external GPIB, then IC22, IC23 and IC24 are suspect. If there is a problem of communication between the controller and the Adapter on the internal GPIB, then IC17, IC18 and IC19 are suspect. The following refer only to the external GPIB. If the problem exists on the internal GPIB, exactly the same procedure should be followed on the equivalent ICs as the circuitry is identical. If a failure occurs, proceed as follows:-

(1) Check that signals on both sides (i.e.inputs and outputs) of bus tranceiver IC22 and IC23 are identical. On the circuit diagram, they are drawn opposite each other; pin 9 equates to pin 12, pin 8 equates to pin 13, etc. Remember that the tranceivers are bidirectional. IC22 handles the data and IC 23 the bus management signals.

(2) If the outputs of IC22 do not equate to the inputs, it may be that the IC is not being enabled. Check that pin 1 (TE - talk enable) and pin 11 (PE - pull-up enable) are toggling high and enabling IC22 as follows:-

Driver inputs			Driver output	Receiver inputs			Receiver output
DATA	TE	PE	GPIB	GPIB	TE	PE	DATA
High	High	High	High	Low	Low	Any	Low
Low	High	Any	Low	High	Low	Any	High

7. IC23 is the bus management transceiver. Not all signals travel in the same direction at the same time. The signals are as follows:-

Signal	Function
TE	Talk enable. Control signal generated by IC24.
DC	Directional control. Control signal generated by IC24.
ATN	Attention. Bus management. Normal transceiver channel that functions additionally as an internal DC or TE for EOI whenever the DC and TE inputs are in the same state. When DC and TE are in opposite states, the ATN channel functions as an independent transceiver only.
SRQ	Service request. Bus management.
REN	Remote enable. Bus management.
IFC	Interface clear. Bus management.
EOI	End or identify. Bus management.
DAV	Data valid. Data transfer.
NDAC	Not data accepted. Data transfer.
NRFD	Not ready for data. Data transfer.

TABLE 5-6 INTELLIGENT BUS INTERFACE PIN ASSIGNMENTS

Pin	IC I/O	Signal	Function
1	Out	T/R1	Transmit/receive control 1. Input and output control signals for GPIB transceivers: T/R1 DI/O0 to DI/O7 DAV NRFD NDAC 1 Out Out In In 0 In In Out Out
2 & 5	Out	T/R2 & T/R3	Function determined by TRM0 and TRM1 values of internal address mode register.
3	In	CLOCK	Reference.
4	In	RESET	Received from controller upon power up.
6	Out	DMA REQ	Indicates a request for DMA has been made. Goes low when a DMA ACK is input.
7	In	$\overline{\text{DMA ACK}}$	Connects quiet I/O data bus to internal data register. When low, data in register outputs to quiet I/O data bus.
8	In	$\overline{\text{CS}}$	Chip select. Enables access to register selected by RS0 to RS2.
9	In	$\overline{\text{RD}}$	Read. Reads contents of read register specified by RS0 to RS2 on D0 to D7.
10	In	$\overline{\text{WR}}$	Write. Writes data on D0 to D7 to write register specified by RS0 to RS2.
11	Out	INT	Interrupt request. Active when internal interrupt request is generated.
12 to 19	I & O	D0 to D7	Adapter quiet I/O data bus.
20		GND	Ground.
21 to 23	In	RS0 to RS2	Register select. Adapter quiet I/O address bus selects internal read or write register for a read or write operation.
24	I & O	$\overline{\text{IFC}}$	Interface clear. Control signal that clears interface function.
25	I & O	$\overline{\text{REN}}$	Remote enable. Selects remote or local control for a device.
26	I & O	$\overline{\text{ATN}}$	Attention. Indicates that data on the DIO lines is an interface message or a device dependent message.
27	I & O	$\overline{\text{SRQ}}$	Service request. Asks controller for service.
28 to 35	I & O	$\overline{\text{DI/O0}}$ to $\overline{\text{DI/O7}}$	8-bit data input/output from/to GPIB through transceiver.
36	I & O	$\overline{\text{DAV}}$	Data valid. Indicates data on DI/O lines is valid.
37	I & O	$\overline{\text{NRFD}}$	Not ready for data. Indicates when GPIB is ready for data.
38	I & O	$\overline{\text{NDAC}}$	Not data accepted. Indicates message has been received.
39	I & O	$\overline{\text{EOI}}$	End of identity. Indicates end of a transfer of multiple bytes. With ATN, executes a parallel poll.
40		Vcc	Power.

8. Using an oscilloscope or, preferably, a logic analyser, check the IC23 truth table as below. Where a signal is missing or has a peculiar level, isolate the source of it which may be anywhere on the bus. If no bus activity can be instigated for the purpose of fault-finding, isolate different parts of the bus and attempt again to instigate activity. A fault anywhere on the GPIB bus can lock the whole bus up. Isolating different parts of it localizes the area that is not working. The signals should be as follows:-

Controls			Bus management channels						Data transfer channels	
DC	TE	ATN	ATN	SRQ	REN	IFC	EOI	DAV	NDAC	NRFD
High	High	High	RX	TX	RX	RX	TX	TX	RX	RX
High	High	Low	RX	TX	RX	RX	RX	TX	RX	RX
Low	Low	High	TX	RX	TX	TX	RX	RX	TX	TX
Low	Low	Low	TX	RX	TX	TX	TX	RX	TX	TX
High	Low	Any	RX	TX	RX	RX	RX	RX	TX	TX
Low	High	Any	TX	RX	TX	TX	TX	TX	RX	RX

9. IC 24 is an intelligent GPIB interface. Fault-finding on it can only take the form of checking the truth table with an oscilloscope for inactive signals and incorrect levels. If any of these emanate from the IC, then it has to be changed. Activity has to be present on the bus while performing these checks. The signals should be as shown in Table 5-6.

DISC CONTROLLER

10. If a problem is experienced with the operation of the disc drive, try a new disc before doing anything else. If it still fails, the most likely area of failure is the disc drive itself (e.g. dirty or worn heads, mechanical wear or failure of the head drive assembly). First, establish whether the problem lies in the Adapter or in the disc drive. This is most easily done by substituting a known good disc drive, if one is available, and checking the operation. Alternatively, substitute a known good Adapter and check the disc operation. Also, carry out the following checks:-

(1) Check the correct fitting of plug PLD in the side of the Adapter. Look for bent pins or splayed sockets.

(2) Ensure the interface cable is undamaged and check it for continuity. Check IC31 pin 18 for an 8 MHz TTL clock signal.

(3) Check the tracks to and from IC30, IC31, IC32, IC33 and IC60 and the two buses for continuity.

(4) On buffer IC32 and IC33, use both channels of an oscilloscope to check that the outputs are the same as the inputs whilst attempting to operate the disc drive.

11. If the fault is definitely shown to be in the Adapter, attempt to control the disc drive from the Adapter and use an oscilloscope to monitor the interface signals as given in Table 5-7. The disc controller IC31 is a large scale device which does not easily lend itself to component level fault finding but if all the signals in Table 5-7 are checked while the controller is attempting to operate the disc drive, a reasonable indication of the condition of the disc controller can be achieved.

12. If no other failing component has been located and there is no fault on the disc drive itself, change the disc controller.

TABLE 5-7 DISC CONTROLLER PIN ASSIGNMENTS

Pin	IC I/O	Signal	Function
1	In	$\overline{CS}$	Chip select. Enables host communication with the device.
2	In	R/$\overline{W}$	Controls the placement of data on D0 to D7 from a selected register (high) or causes write operation to a selected register (low).
3 & 4	In	A0 & A1	Address inputs select a register to read/write data.
5 to 12	I & O	DAL0 to DAL7	8-bit bidirectional bus used for transfer of data, control or status. Bus enabled by CS and R/W.
13	In	$\overline{MR}$	Master reset. Resets the device and initializes the status register.
14		GND	Ground.
15		Vcc	Power supply.
16	Out	STEP	Each pulse instructs the disc heads to step one track.
17	Out	DIRC	Informs direction of stepping - in (high) or out (low).
18	In	CLK	8 MHz clock.
19	Out	RD	Raw data from drive containing clock and data pulses.
20	Out	MO	Enables spindle motor prior to read, write or step operations.
21	Out	WG	Made valid prior to writing on the disc.
22	Out	WD	FM or MFM clock and data pulses to be written on the disc.
23	In	$\overline{TR00}$	Informs controller that read/write heads are on track 0.
24	In	$\overline{IP}$	Informs controller when disc index hole is detected.
25	In	$\overline{WPRT}$	Write protect. Set by detection of disc "write enable". When active, writing is disabled.
26	In	$\overline{DDEN}$	Selects either single density FM (high) or double density MFM (low).
27	Out	DRQ	Indicates data register is full (on a read) or empty (on a write).
28	Out	INTRQ	Set at the completion of any command or reset a read of the status register.

SAT GENERATOR

13. The SAT Generator circuitry is used by NMT, AMPS and TACS. Switch on the equipment, confirm selection of or change to one of these systems and select MANUAL TEST and DATA OFF. Select a SAT FREQ of 3 kHz and a SAT LEVEL of 2.5 kHz.

Interval timer

14. This is to check counter 0 (÷ 4), counter 1 (÷ 2400), counter 2 (÷ N) and PLL. Proceed as follows:-

(1) Check for the reference clock input on IC20 pin 15. This should be a pulse train of 3.84 MHz at TTL level. Check for a 160 Hz pulse train at TTL level on IC20 pin 13.

(2) Set the SAT generator for 3 kHz. Counter 2 of interval timer IC20 should be dividing by 600.

(3) If the loop is locking correctly at 3 kHz, IC20 pin 18 has a 96 kHz TTL pulse train.

(4) Check for a TTL pulse train on IC20 pin 17. This should be the frequency on pin 18 divided by 600. If the loop is locking, pin 17 is at 160 Hz.

(5) Check IC20 pin 10 for a pulse train at TTL levels and a frequency of 24 kHz (i.e. the input on pin 9 divided by 4).

IC51 (Divide by 8)

15. Proceed as follows:-

(1) Check for the waveform in Fig. 5-15 at IC45 pin 10.

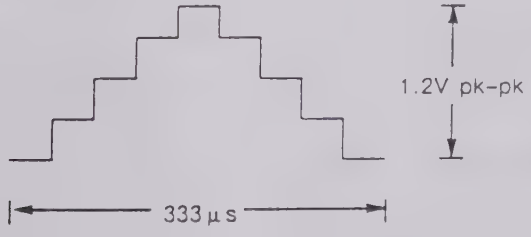

Fig. 5-15 Waveform at IC45 pin 10

(2) To check that the SAT generator is locking correctly at its upper end of the range, set the SAT generator to 8 kHz and check for the following:-

(a) On IC20 pin 18, TTL pulses at 256 kHz.
(b) On IC20 pin 10, TTL pulses at 64 kHz

10 kHz LP filter

16. On IC45 pin 1, check for a clean sine wave of approximately 1.2 V pk-pk.

Level control IC28 and IC44

17. The following check is only valid if the instrument passed its SAT calibration and is then only approximate as the level depends on the sensitivity of the EXT MOD I/P of the 2955 being used. Proceed as follows:-

(1) With the instrument set to give a SAT frequency of 3 kHz at a modulation level of 2.5 kHz, check for a sine wave of approximately 1 V pk-pk on IC44 pin 1 and an output of 0.5 V pk-pk on IC44 pin 8.

18. If the instrument failed its SAT calibration or more detailed testing of the level control is required, either a GPIB or RS-232 controller has to be connected. Proceed as follows:-

(1) Switch on the equipment and select MANUAL TEST and DATA OFF.

(2) Connect a DVM, set to measure AC V RMS, with a X1 oscilloscope probe to IC44 pin 1.

(3) The address for DAC IC28 is 64. To set the DAC to full output, send command "POI64,255" from the controller.

(4) Note the reading on the DVM which should be 400 mV ±15%. Divide this by 255 to obtain the DAC step value.

(5) From the controller, send the following data to IC 28 and check on the DVM for the following readings:-

Data to DAC	Reading on DVM mV
254	DAC step value x 254
253	DAC step value x 253
251	DAC step value x 251
247	DAC step value x 247
239	DAC step value x 239
223	DAC step value x 223
191	DAC step value x 191
127	DAC step value x 127

IC44c

19. When being fed from SAT generator, amplifier IC44c has a gain of approximately 0.5.

(1) Using the controller, set the DAC to full output (POI64,255) and check on the DVM for approximately 200 mV RMS on IC44 pin 8.

IF DEMODULATION PATH

20. Proceed as follows:-

(1) Connect the Adapter to the 2955 as for normal operation and switch on the equipment.

(2) On the 2955, select TRANSMITTER TEST and the BNC connector.

(3) Connect a signal generator to the BNC socket. Set the signal generator to supply a carrier frequency of 470 MHz at an RF level of 0 dBM with modulation off.

(4) Using an oscilloscope, check for a 110 kHz sine wave of approximately 2 V pk-pk on the Adapter motherboard A1 tag 5.

(5) Check for the same signal on IC46 pin 6.

Limiter

21. Check IC47 pin 6 for a 110 kHz square wave of 20 V.

Discriminator

22. Proceed as follows:-

(1) Check IC48 pin 13 for a TTL pulse train with a repetition rate of 9.4 μs and a pulse width of 3.4 μs.

(2) Check the adjustment of R61 and R73 as described in the setting up procedure.

(3) Check IC49 pin 7 for 0 V. There should be less than 100 mV pk-pk noise.

(4) Set the external signal generator to give 5 kHz FM deviation at 1 kHz modulation frequency. At IC47 pin 6, IC48 pin 13 and IC49 pin 1, check for the waveforms in Fig. 5-16, Fig. 5-17 and Fig. 5-18.

(5) Check IC49 pin 14 for a 1 kHz sine wave of approximately 0.6 V pk-pk.

(6) Check IC49 pin 8 for a 1 kHz sine wave of approximately 0.6 V pk-pk.

(7) Check IC49 pin 7 for a 1 kHz sine wave of approximately 2 V pk-pk.

(8) Check IC53 pin 7 for a 1 kHz sine wave of approximately 2 V pk-pk.

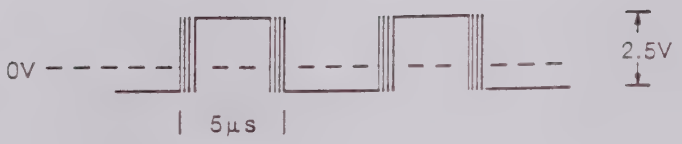

Fig. 5-16 Waveform at IC47 pin 6

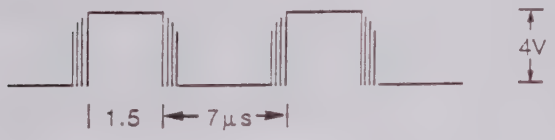

Fig. 5-17 Waveform at IC48 pin 13

Fig. 5-18 Waveform at IC49 pin 1

DC AMMETER CIRCUIT

23. Proceed as follows:-

(1) Connect a 5 Ω 25 W load across the inner DC connectors on the rear panel.

(2) Connect a DC power supply (capable of supplying 2 A at 10 V) across the outer DC connectors on the rear panel. Set the output to 10 V.

(3) Use the DVM to check the junction of R75 and R76 for a DC voltage of 0.4 V with respect to ground (i.e. supply voltage divided by 25).

(4) Check for approximately 10 V DC with respect to ground on board A1 tag 12.

(5) Check that board A1 tag 13 is approximately 0.02 V lower than that measured at tag 12. This checks the 0.01 Ω resistor.

(6) Check for approximately 3.4 V DC with respect to ground on IC54 pins 2 and 3.

(7) Check for -0.2 V DC with respect to ground (i.e. supply current divided by 10) on IC55 pin 6.

MOTHERBOARD TIMING SIGNALS

Microprocessor clock

24. Proceed as follows:-

(1) Switch on the equipment.

(2) Check IC1 pin 37 for TTL clock pulses at 3.84MHz.

(3) Check that the same signal appears at IC2 pin 16.

(4) Check that IC1 pin 36 is held TTL high.

IC61 (Divide by 64)

25. Check IC61 pin 10 for a TTL pulse train of 60 kHz (16.6 μs).

Interval timer IC21

26. Proceed as follows:-

(1) Check IC21 pin 17 for a 17 μs low pulse every second.

(2) Press the CRTS key. When the self-calibration is complete, select MANUAL TEST.

(3) Check IC21 pin 13 for the following, depending upon which system is selected.

System	IC21 pin 13
NMT	Not used (TTL high)
AMPS	10 kHz square wave
TACS	8 kHz square wave
RC2000	Not used (TTL high)
Band III	Not used (TTL high)

27. IC21 pin 10 provides the baud rate clock for the serial port. To check this, proceed as follows:-

(1) Select the INTERFACE MENU.

(2) In turn, select the following baud rates and check IC21 pin 10 for a TTL pulse train with a repetition rate as follows:-

Baud rate	IC21 pin 10
75	0.84 ms
150	0.42 ms
300	0.21 ms
600	0.11 ms
1200	0.05 ms
2400	25 μs
4800	12.5 μs
9600	6.25 μs

Interrupt controller

28. Check IC12 pin 17 for a TTL pulse of approx 5 μs duration every second.

KEYBOARD A2 AND KEYBOARD INTERFACE BOARD A3

29. To check the keyboard and interface, proceed as follows:-

(1) On board A3 SKB, check for +5 V on pins 8 and 9.

(2) Check that PLA pins 1, 2, 3 and 4 are all high.

(3) Check that IC1 pin 8 is low.

(4) Press each of the keys in turn and check that IC1 pin 8 goes high each time.

(5) Press any one of the keys and check that IC2 pin 1 is pulsed low.

(6) Press the 2955 key and check that the 2955 LED D1 is on. The LEDs are controlled by latch IC25 on the motherboard A1.

(7) Check that SKA pin 7 is low and pins 8, 9 and 10 are high.

(8) Press the PSOPH/LOCAL key and check that LEDs D1 and D4 are on, SKA pins 7 and 10 are low and pins 8 and 9 are high.

(9) Press the DISC key. Check that LEDs D3 and D4 are on, SKA pins 9 and 10 are low and pins 7 and 8 are high.

(10) Press the CRTS key. Check that LED D2 is on, SKA pin 8 is low and pins 7, 9 and 10 are high.

PERSONALITY BOARD B4

30. The following sections describe the procedures for finding a fault on the personality board B4.

SAT FILTERS AND DETECTORS

4 kHz SAT filter and detector

31. This area of circuitry is used by NMT only. The adjustment of B4 R50 affects the following checks. Proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-calibration is complete, select NMT if this is not already selected.

(2) Enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL. When this is done, enter the MANUAL TEST mode and select DATA OFF mode.

(3) Set an LF generator to give 177 mV RMS at a frequency of 4 kHz and connect this to the EXT MOD INPUT of the Adapter. Using a DVM set to measure AC V, check that this signal appears on TP1 of board B4.

(4) Transfer the DVM to TP7 and check that the level indicated on the DVM is approximately 0.7 V.

(5) Adjust the LF generator level until the DVM shows exactly 1 V.

(6) Set the LF generator frequency as follows and check that the level at TP7 meets the following limits:-

LF generator frequency	Level at TP7	
	V	dB
2.000 kHz	<0.252	<-12
3.700 kHz	<0.795	<-2
3.955 kHz	0.972 to 1.03	±0.25
4.000 kHz	Ref. (1.000)	Ref. (0)
4.045 kHz	0.972 to 1.03	±0.25
4.300 kHz	<0.795	<-2
6.000 kHz	<0.252	<-20

(7) Set the LF generator to 3.955 kHz and a level of 38 mV.

(8) Using an oscilloscope along the SAT detector path, check at IC26 pin 14 and IC14 pin 9 for the waveforms in Fig. 5-19 and Fig. 5-20.

(9) Check TP15 for +5 V.

(10) Using an oscilloscope set to 2V/div and a time-base of 0.1 ms/div, check at IC39 pin 16 for the waveform in Fig. 5-21.

(11) Finally, check on the display that ON appears in reverse. This checks that the processor is able to read the status of the SAT detector through IC39 or IC33.

(12) Set the LF generator level to 10 mV and check for a low level on TP15. Check that ON no longer appears on the display.

(13) Set the LF generator to 4.045 kHz and a level of 38 mV.

(14) Monitor TP15 with the DVM, set to measure DC V, and check for a high level. Check on the display that ON appears in reverse.

(15) Set the LF generator level to 10 mV and check for a low level on TP15. Check that ON no longer appears on the display.

6 kHz SAT filter and detector

32. This area of circuitry is used by AMPS and TACS only. The adjustment of B4 R66 affects the following checks. Proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-calibration is complete, select either AMPS or TACS if neither of these is already selected.

(2) Enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL. When this is done, enter the MANUAL TEST mode and select DATA OFF mode.

(3) Set an LF generator to give 0.707 V RMS at a frequency of 6 kHz and connect this to the EXT MOD INPUT of the Adapter. Using a DVM set to measure AC V, check that this signal appears on TP1 of board B4.

(4) Transfer the DVM to TP8 and check that the level indicated on the DVM is approximately 0.7 V.

(5) Adjust the LF generator level until the DVM shows exactly 1 V.

(6) Set the LF generator frequency as follows and check that the level at TP8 meets the following limits:-

LF generator frequency	Level at TP8	
	V	dB
4.000 kHz	<0.100	<-20
5.700 kHz	<0.631	<-4
5.970 kHz	0.972 to 1.03	±0.25
6.000 kHz	Ref. (1.000)	Ref. (0)
6.030 kHz	0.972 to 1.03	±0.25
6.300 kHz	<0.631	<-4
8.000 kHz	<0.100	<-20

(7) Set the LF generator to 5.970 kHz and a level of 206 mV.

(8) Using an oscilloscope along the SAT detector path, check at IC26 pin 14 and IC14 pin 9 for the waveforms in Fig. 5-19 and Fig. 5-20.

(9) Check TP15 for +5 V.

(10) Using an oscilloscope set to 2 V/div and a time-base of 0.1 ms/div, check at IC39 pin 16 for the waveform in Fig. 5-21.

(11) Finally, check on the display that SAT appears in reverse. This checks that the processor is able to read the status of the SAT detector through IC39 or IC33.

(12) Set the LF generator level to 50 mV and check for a low level on TP15. Check that SAT no longer appears on the display.

(13) Set the LF generator to 6.030 kHz and a level of 206 mV.

(14) Monitor TP15 with the DVM, set to measure DC V, and check for a high level. Check on the display that SAT appears in reverse.

(15) Set the LF generator level to 50 mV and check for a low level on TP15. Check that SAT no longer appears on the display.

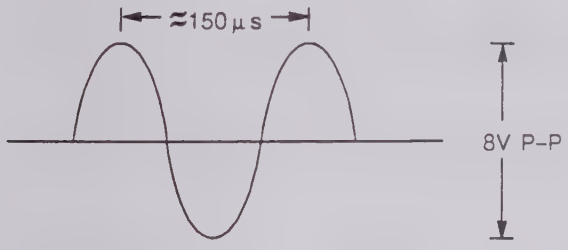

Fig. 5-19 Waveform at IC26 pin 14

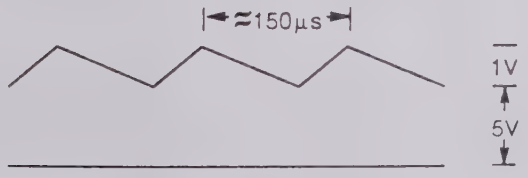

Fig. 5-20 Waveform at IC14 pin 9 and D5 cathode

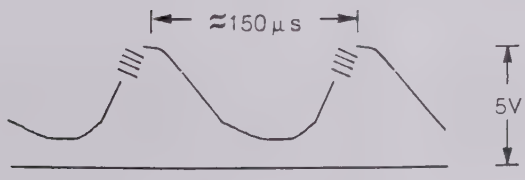

Fig. 5-21 Waveform at IC39 pin 16 and IC39 pin 15

8 to 10 kHz SAT filter and detector

33. This area of circuitry is used by AMPS and TACS only. Proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-calibration is complete, select either AMPS or TACS if neither of these is already selected.

(2) Enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCe to EXTERNAL. When this is done, enter the MANUAL TEST mode and select FCC mode.

(3) Set an LF generator to give 1 V RMS at a frequency of 9 kHz and connect this to the EXT MOD INPUT of the Adapter. Using a DVM, set to measure AC V, check that this signal appears on TP1 of board B4. Adjust the LF generator level until the DVM indicates exactly 1 V.

(4) Transfer the DVM to TP9.

(5) Set the LF generator frequency as follows and check the level at TP9 meets the following limits:-

LF generator frequency	Level at TP9	
	V	dB
1.000 kHz	<0.0178	<-35
4.000 kH	<0.178	<-15
6.000 kHz	<1.26	<+2
8.000 kHz	3.16 to 3.98	11 ±1
10.000 kHz	2.51 to 3.55	9 ±1
20.000 kHz	<1.413	<+3

(5) Set the LF generator to 8.000 kHz and a level of 770 mV.

(6) Using an oscilloscope, check at diode D5 cathode for the waveform in Fig. 5-20.

(7) Check TP16 for +5 V.

(8) Using an oscilloscope, set to 2 V/div and a time-base of 0.1 ms/div, check at IC39 pin 15 for the waveform in Fig. 5-21.

(9) Set the mode to DATA OFF and check on the display that ST appears in reverse. This checks that the processor is able to read the status of the SAT detector through IC39 or IC33. (It is possible that the Adapter automatically switches back to FCC mode at this point.)

(10) Set the LF generator level to 254 mV and check for a low level on TP16.

(11) Set the LF generator to 10.000 kHz and a level of 962 mV.

(12) Monitor TP16 with the DVM, set to measure DC V, and check for a high level.

(13) Set the LF generator level to 318 mV and check for a low level on TP16.

PSOPHOMETRIC FILTER CIRCUIT - CCITT

34. The CCITT filter circuitry is used by NMT, TACS, NMT, RC2000 and Band III. The filter is built around quad amplifier IC40, IC41 and IC42. If any of these fail, it is fairly easy to determine the defective component. The difficulty arises when the response of the filter is incorrect (e.g. due to a resistor or capacitor failing or ageing). The table below should assist in locating the area that is causing the problem. The figures given for TP13 are affected by the adjustment of R149. After carrying out the normal filter performance check, proceed as follows:-

(1) Switch on the equipment and press the PSOPH key. The 2955 and the PSOPH LEDs should both light.

(2) Connect an LF generator to the AF INPUT of the Adapter.

(3) Adjust the generator to supply 2 V at a frequency in the table that gave a particularly bad response during the performance check.

(4) Set a DVM to read AC V RMS and connect it with a X1 oscilloscope probe to the output of each stage in turn, checking for the voltages at each frequency as follows:-

Frequency (Hz)	Voltage (V)					
	IC40		IC41		IC42	TP13
	pin 14	pin 1	pin 8	pin 14	pin 1	
150	0.037	0.008	0.008	0.008	0.008	0.071
200	0.067	0.024	0.024	0.024	0.024	0.184
300	0.148	0.088	0.082	0.082	0.082	0.577
400	0.233	0.171	0.153	0.153	0.155	0.993
500	0.330	0.270	0.230	0.231	0.236	1.379
600	0.430	0.373	0.301	0.304	0.314	1.670
800	0.620	0.571	0.415	0.426	0.451	2.000
1000	0.830	0.788	0.519	0.544	0.590	2.220
1200	0.882	0.849	0.515	0.533	0.615	2.000
1500	0.982	0.958	0.530	0.598	0.671	1.790
2000	1.094	1.077	0.562	0.709	0.712	1.465
2500	1.156	1.143	0.641	0.947	0.723	1.205
3000	1.192	1.182	0.786	1.428	0.785	1.098
3500	1.216	1.207	0.714	1.634	0.656	0.789
4000	1.232	1.225	0.401	1.000	0.303	0.320
5000	1.252	1.245	0.144	0.200	0.037	0.031

PSOPHOMETRIC FILTER CIRCUIT - C-MESSAGE

35. The C-message filter circuitry is used by AMPS. The filter is built around quad amplifier IC42 and IC43. If either of these fail, it is fairly easy to determine the defective component. The difficulty arises when the response of the filter is incorrect (e.g. due to a resistor or capacitor failing or ageing). The table below should assist in locating the area that is causing the problem. The figures for TP14 are affected by the adjustment of R170. After carrying out the normal filter performance check, proceed as follows:-

(1) Switch on the equipment and press the PSOPH key. The 2955 and the PSOPH LEDs should both light.

(2) Connect an LF generator to the AF INPUT of the Adapter.

(3) Adjust the generator to supply 2 V at a frequency in the table that gave a particularly bad response during the performance check.

(4) Set a DVM to read AC V RMS and connect it with a X1 oscilloscope probe to the output of each stage in turn, checking for the voltages at each frequency as follows:-

Frequency (Hz)	Voltages (V)					
	IC43				IC42	TP14
	pin 1	pin 7	pin 8	pin 14	pin 8	
90	0.017	0.006	0.005	0.005	0.005	0.010
200	0.095	0.066	0.060	0.060	0.060	0.108
300	0.227	0.189	0.172	0.171	0.172	0.301
400	0.391	0.350	0.320	0.321	0.324	0.550
500	0.605	0.562	0.517	0.520	0.528	0.867
600	0.834	0.790	0.732	0.742	0.757	1.195
700	1.039	0.998	0.931	0.951	0.977	1.479
800	1.200	1.163	1.092	1.127	1.167	1.690
900	1.336	1.302	1.234	1.286	1.344	1.859
1000	1.457	1.426	1.364	1.439	1.519	2.000
1200	1.384	1.362	1.329	1.443	1.557	1.870
1300	1.370	1.351	1.332	1.471	1.606	1.840
1500	1.354	1.340	1.351	1.546	1.731	1.812
1800	1.337	1.326	1.378	1.681	1.959	1.804
2000	1.327	1.318	1.391	1.779	2.127	1.807
2500	1.312	1.305	1.372	1.988	2.467	1.748
2800	1.306	1.300	1.306	2.010	2.467	1.586
3000	1.303	1.297	1.240	1.950	2.329	1.409
3300	1.300	1.294	1.119	1.739	1.933	1.074
3500	1.297	1.292	1.031	1.536	1.597	0.841
4000	1.293	1.289	0.821	0.994	0.840	0.391
4500	1.290	1.286	0.650	0.600	0.402	0.167
5000	1.289	1.285	0.520	0.366	0.196	0.073

DE-EMPHASIS FILTER

36. The 2955 can be used to check the de-emphasis filter as follows:-

(1) Switch off the equipment and remove connector PLH.

(2) Switch on the equipment.

(3) Set the 2955 to **AUDIO TEST**.

(4) Set an AF generator to give 0.2 V at 50 Hz. Connect the AF GEN OUTPUT to TP1.

(5) Use a X1 oscilloscope probe to connect the 2955 AF INPUT to IC9 pin 1.

(6) Select the 50 kHz low pass filter on the 2955.

(7) The 2955 AF voltmeter reading should indicate approximately 6 dBV.

(8) Press the dB key on the 2955. The dBR display should now indicate 0.0 dBR.

(9) Set the 2955 AF generator to the following frequencies and check for the following dBR values:-

Frequency	Typical level
50 Hz	Ref. 0 dBR
200 Hz	-6 dBR
500 Hz	-13 dBR
800 Hz	-17 dBR
1300 Hz	-21 dBR
2000 Hz	-25 dBR
4000 Hz	-31 dBR
7000 Hz	-36 dBR
10000 Hz	-39 dBR

CLOCK AND TONE GENERATOR

37. IC18 is used for the following:-

(a) Supplying both the low and high tones for checking the DTMF receiver circuitry during self-calibration on AMPS, TACS and RC2000.

(b) Providing the clock signal for the 50 baud FSK modem used by RC2000.

(c) Providing the clock signal required by low pass filter IC12 that is used for filtering the outputs from the modems of all the systems.

38. IC18 is fully checked during instrument self-calibration but the checks below can be made as an aid to fault diagnosis.

10 MHz clock - All systems

39. Using an oscilloscope, check for a 10MHz (0.1 μs) TTL pulse train on IC18 pins 9, 15 and 18. This confirms that the oscillator circuit built around XL3, IC19 and IC20 is working.

DTMF tone output - AMPS, TACS and RC2000

40. Proceed as follows:-

(1) Monitor IC18 pin 10 with an oscilloscope.

(2) Run the instrument self-calibration for one of the above systems. At the point that the display indicates checking DTMF DETECTOR, check on the oscilloscope for 16 bursts of a TTL square wave with a repetion rate of approximately 80 μs.

(3) Connect the oscilloscope to IC18 pin 17.

(4) Run the instrument self-calibration for one of the above systems. At the point that the display indicates checking DTMF FS LEVEL, check on the oscilloscope for a 3 second TTL square wave burst of approximately 0.8 ms repetion rate followed by another 3 second burst and finally by 16 short bursts.

Clock for modem LPF IC12 - All systems

41. Proceed as follows:-

(1) Monitor IC18 pin 13 with an oscilloscope.

(2) Run the instrument self-calibration. A number of pulse bursts should be seen and finally, at the end of the calibration sequence, there should be a 1 MHz TTL square wave.

(3) Select MANUAL TEST and check IC18 pin 13 for the following:-

System	Mode	Signal at IC18 pin 13
NMT	COMBINED CC/TC	625 kHz (1.6 μs) TTL square wave
AMPS	FCC	1 MHz (1 μs) TTL square wave
TACS	FCC	833 kHz (1.2 μs) TTL square wave
RC2000	VEILLE	625 kHz (1.6 μs) TTL square wave
Band III	CONTROL CHANNEL	625 kHz (1.6 μs) TTL square wave

DTMF tone path - AMPS, TACS and RC2000

42. If the self-calibration is run for any of the above systems, the following signals can be checked on an oscilloscope:-

Test point	Signal
IC13 pin 8	A burst of stepped sinewaves of 5 V pk-pk at a rate of approximately 1.3 ms. This checks the operation of IC10 to IC13.
IC17 pin 14	TTL high level for 3 seconds, a brief low level, another 3 second high level followed by a burst of 16 high levels.
IC19 pin 3	4 second TTL pulse train of approximately 825 μs followed by a brief high level followed by another 4 second pulse train and finally 16 bursts of square waves. This checks the operation of IC17 pin 14 and IC19a gate.
TP6	At the point that the self-calibration carries out the DTMF DETECTOR test, check for 16 bursts of DTMF signals of approximately 1.5 V pk-pk. This checks that the mixed tones are being passed through IC13a, IC12 and IC13b.

DTMF RECEIVER - AMPS, TACS AND RC2000

43. Proceed as follows:-

(1) Switch on the equipment.

(2) Before pressing the CRTS key, check for the following at IC21:-

IC21	Signal
Pins 1, 2, 3 and 4	2.5 V DC
Pin 8	3.579545 MHz sine 2 V pk-pk and 1.5 V above ground
Pins 10, 15, 16 and 17	TTL low
Pins 11, 12, 13 and 14	1.5 V DC

(2) Run the self-calibration of one of the above systems and, at the point that the DTMF tests are carried out, check for the following on an oscilloscope:-

IC21	Signal
Pin 3	16 bursts of DTMF signals approximately 3 V pk-pk when the self-calibration reaches DTMF DETECTOR.
Pin 15	16 TTL high pulses during the DTMF DETECTOR check. (These can best be seen with the oscilloscope set to 20 ms/div.)

44. Proceed as follows:-

(1) Switch on the equipment and press the CRTS key. When the self-calibration is complete enter the **DIVERS MENU** and set SIGNAL DEMODULE DU 2955 to SIGNAL DEMODULE EXTERNE.

(2) Connect an LF synthesizer, set to give 150 Hz at a level of 250 mV, to the EXT MOD INPUT of the Adapter.

(3) Connect a DVM, set to measure AC V, to TP1 and adjust the LF synthesizer level slightly until the DVM indicates exactly 250 mV.

(4) Transfer the DVM to TP3 and check for a level between 1.577 V and 1.986 V (17 dB gain ±1 dB).

(5) Adjust the LF synthesizer level until the DVM reads as close to 1.76986 V as possible.

(6) Set the LF synthesizer to each of the following frequencies and check for the correct filter response:-

Frequency	DVM level	Response
70 Hz	<0.177 V	<-20 dB
136 Hz	1.7097 to 1.8321 V	±0.3 dB
150 Hz	Ref.	Ref.
164 Hz	1.7097 to 1.8321 V	±0.3 dB
300 Hz	<0.177 V	<-20 dB

(7) Set the LF synthesizer to give 150 Hz at 250 mV. Using an oscilloscope, check IC15 pin 1 for a 150 Hz 5 V square wave.

(8) Return the demodulation source to SIGNAL DEMODULE DU 2955. Enter the MANUAL TEST mode and select 164 Hz mode. Using an oscilloscope, check for the following:-

IC15	Signal
Pin 4	139 kHz (7.2 µs) TTL square wave
Pins 11 and 7	TTL low
Pin 12	TTL high

(9) Check TP6 for a 164 Hz sine wave of 150 mV pk-pk.

(10) Set the mode to 136 Hz and check for the following:-

Test point	Signal
IC15 pin 11	TTL high
TP6	136 Hz sine wave at 150 mV pk-pk

(11) Set the mode to INFRA ALTERNEES and check IC15 pin 11 for a 40 ms TTL square wave.

1200 baud FFSK MODEM - NMT, RC2000 and BAND III

NMT

45. Proceed as follows:-

(1) Switch on the equipment and run the CRTS calibration. When this is complete, enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL.

(2) Connect an LF synthesizer, set to give 1500 Hz at 495 mV, to the EXT MOD INPUT on the Adapter.

(3) Monitor IC11 pin 15 with an oscilloscope and check for a 1 V pk-pk sine wave 0.6 V above ground.

(4) Set the LF synthesizer frequency to 1.2 kHz and check that IC11 pins 13 and 14 are both TTL high.

(5) Return the DE-MOD SOURCE to INTERNAL.

(6) Enter the MANUAL TEST mode and select 1200 Hz mode.

(7) Using an oscilloscope, check for the following:-

Test point	Signal
IC11 pin 2	4 V pk-pk 1 MHz pulse train
IC11 pin 13	TTL low level
IC11 pin 14	TTL low level
IC11 pin 3	1200 Hz TTL square wave
IC11 pin 17	1200 Hz TTL square wave
IC11 pin 6	TTL high level
TP6	0.5 V pk-pk 1200 Hz sine wave

(8) Select 1800 Hz mode and check for the following:-

Test point	Signal
IC11 pin 6	TTL low level
TP6	0.5 V pk-pk 1800 Hz sine wave

(9) Select DOTTING mode and check IC11 pin 6 for a 600 Hz TTL square wave.

RC2000

46. Proceed as follows:-

(1) Switch on the equipment and run the CRTS calibration. When this is complete enter, the **DIVERS MENU** and set DEMODULE DU 2955 to SIGNAL DEMODULE EXTERNE.

(2) Connect an LF synthesizer, set to give 1500 Hz at 215 mV, to the EXT MOD INPUT on the Adapter.

(3) Monitor IC11 pin 15 with an oscilloscope and check for a 1 V pk-pk sine wave 0.6 V above ground.

(4) Set the LF synthesizer frequency to 1.2 kHz and check that IC11 pins 13 and 14 are both TTL high.

(5) Return the demodulation source to SIGNAL DEMODULE DU 2955.

(6) Enter the MANUAL TEST mode and select 1200 Hz mode.

(7) Using an oscilloscope, check for the following:

Test point	Signal
IC11 pin 2	4 V pk-pk 1 MHz pulse train
IC11 pin 13	TTL low level
IC11 pin 14	TTL low level
IC11 pin 3	1200 Hz TTL square wave
IC11 pin 17	1200 Hz TTL square wave
IC11 pin 6	TTL high level
TP6	0.5 V pk-pk 1200 Hz sine wave

(8) Select 1800 Hz mode and check for the following:-

Test point	Signal
IC11 pin 6	TTL low level
TP6	0.5 V pk-pk 1800 Hz sine wave

(9) Select DONNES ALTERNES mode and check IC11 pin 6 for a 600Hz TTL square wave.

Band III

47. Proceed as follows:-

(1) Switch on the equipment and run the CRTS calibration. When this is complete, enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL.

(2) Connect an LF synthesizer, set to give 1500 Hz at 215 mV, to the EXT MOD INPUT.

(3) Monitor IC11 pin 15 with an oscilloscope and check for a 1 V pk-pk sine wave 0.6 V above ground.

(4) Set the LF synthesizer frequency to 1.2 kHz and check that IC11 pins 13 and 14 are both TTL high.

(5) Return the DE-MOD SOURCE to INTERNAL.

(6) Enter the MANUAL TEST mode and select 1200 Hz mode.

(7) Using an oscilloscope, check for the following:-

Test point	Signal
IC11 pin 2	4 V pk-pk 1 MHz pulse train
IC11 pin 13	TTL low level
IC11 pin 14	TTL low level
IC11 pin 3	1200 Hz TTL square wave
IC11 pin 17	1200 Hz TTL square wave
IC11 pin 6	TTL high level
TP6	0.5 V pk-pk 1200 Hz sine wave

(8) Select 1800 Hz mode and check for the following:-

Test point	Signal
IC11 pin 6	TTL low level
TP6	0.5 V pk-pk 1800 Hz sine wave

(9) Select DOTTING mode and check IC11 pin 6 for a 600 Hz TTL square wave.

FSK AND MANCHESTER MODEM - AMPS AND TACS

AMPS

48. Before attempting to fault-find around the modem circuitry, it should be ensured that the adjustments R34 on B4 board and R61 and R73 on the motherboard are set up correctly as maladjustment of these can cause modem failures during the instrument self-calibration or failure of mobiles to register. Proceed as follows:-

(1) Switch on the equipment and run the CRTS calibration. When this is complete, enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL.

(2) Connect an LF synthesizer, set to give 10 kHz at 1 V RMS, to the EXT MOD INPUT of the Adapter.

(3) Monitor IC17 pin 8 with an oscilloscope and check for a 10 kHz TTL square wave.

(4) Enter the MANUAL TEST mode and select PLACE CALL mode.

(5) Using an oscilloscope and frequency counter, check for the following:-

Test point	Signal
IC17 pins 2, 15 and 16	10 kHz TTL square wave
IC17 pins 4, 6 and 11	TTL high level
IC17 pins 5, 7 and 18	TTL low level
IC17 pins 3 and 19	TTL data
IC17 pin 1	40 kHz TTL square wave
IC17 pin 13	10 kHz pulses of width 2 μs

TACS

49. Before attempting to fault-find around the modem circuitry, it should be ensured that the adjustments R33 on B4 board and R61 and R73 on the motherboard are set up correctly as maladjustment of these can cause modem failures during the instrument self-calibration or failure of mobiles to register. Proceed as follows:-

(1) Switch on the equipment and run the CRTS calibration. When this is complete, enter the **MISCELLANEOUS MENU** and set the DE-MOD SOURCE to EXTERNAL.

(2) Connect an LF synthesizer, set to give 8 kHz at 700 mV, to the EXT MOD INPUT on the Adapter.

(3) Monitor IC17 pin 8 with an oscilloscope and check for a 8 kHz TTL square wave.

(4) Enter the MANUAL TEST mode and select PLACE CALL mode.

(5) Using an oscilloscope and frequency counter. check for the following:-

Test point	Signal
IC17 pins 2, 15 and 16	8 kHz TTL square wave
IC17 pins 4, 5, 6 and 11	TTL high level
IC17 pins 7 and 18	TTL low level
IC17 pin 3 and 19	TTL data
IC17 pin 1	32 kHz TTL square wave
IC17 pin 13	8 kHz pulses of width 1.4 μs

POWER SUPPLY BOARD A4

50. To find out which voltages are incorrect or missing, proceed as follows:-

(1) Check that the AC supply voltage complies with the voltage selected on the rear panel and that the mains cable is fitted between the AC SUPPLY OUT on the Adapter and the AC SUPPLY connector on the 2955.

(2) Check that neither of the two back panel fuses have blown and that they are of the correct value (i.e. 500 mA (time lag) for 105 V to 250 V and 250 mA for 210V to 240V).

(3) Test the DC output from the power supply board A4 at PLJ on the motherboard, pin 1 ground, pin 2 +5 V, pin 5 +12 V and pin 6 -12 V. Check with PLH connected and disconnected to check for loading.

(4) If all voltages are correct, check with an oscilloscope that unacceptable amounts of ripple are not present.

+12 V absent

51. If +12 V is absent from SKJ pin 5, proceed as follows:-

(1) Switch the power off and remove SKJ and fuse FS1.

(2) Check that the input of regulator IC1 which should be between 15 and 23 V DC. If this is correct, the regulator is at fault and should be changed.

(3) If the input of regulator IC1 is incorrect, check for approximately 18.5 V AC at contacts 1 and 2 (i.e. the input from the transformer). With correct AC input, the fault has to lie within the diode bridge or smoothing capacitors C1 and C2.

(4) If all checks are good, switch off and replace FS1. Switch on again and, if +12 V becomes defective, the fault has to lie in the 5 V circuitry.

-12 V absent

52. If -12 V is absent from SKJ pin 6, proceed as follows:-

(1) Remove the metal cover fro regulator IC2 and check the input across C5 which should be between 15 and 23 V DC. If this is correct, the regulator is at fault and should be changed.

(2) If the input of IC2 is incorrect and there is approximately 18.5 V AC at contacts 3 and 4 then the fault lies within the diode bridge or C5.

+5 V absent

53. If the +5 V is absent from pin 3, proceed as follows:-

(1) Check that the board-mounted fuse FS1 is not blown. If it is, ascertain why before replacing it.

(2) Check for 15 to 23 V DC at the input side of FS1. If this is not present, +12 V is also absent and the problem lies in the transformer, the diode bridge or smoothing capacitors C1 and C2

(3) Check for 15 to 23 V DC at the TR3 source. If the source voltage is present but the drain signal as shown in Fig. 5-22 is absent then TR3 is not switching.

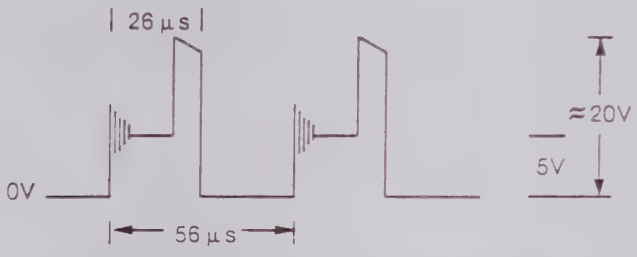

Fig. 5-22 Waveform at TR3 drain

(4) Check for 20 V 25 kHz as shown in Fig. 5-23 at the TR3 gate. If this is present then TR3 is defective and has to be replaced.

Fig. 5-23 Waveform at TR3 gate

(5) If 20 V 25 kHz is not present on the TR3 gate, check for pulses of approximately 20 V at the junction of R3 and R4.

(6) If these pulses are present, then either TR1 or TR2 is defective and should be changed. If the pulses are not present, then suspect D5 or IC3. The normal output of IC3 pins 15 and 16 is shown in Fig. 5-24.

(7) If the +5 V output on PLJ pin 5 is negative, D6 should be replaced. If there is excessive ripple on it then L3 and C11 are suspect.

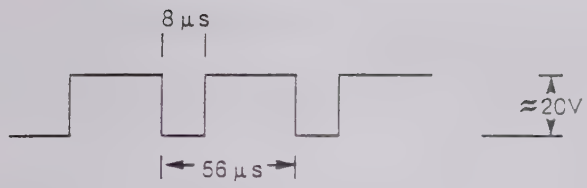

Fig. 5-24 Waveform at IC3 pins 15 and 16

AC/DC POWER SUPPLY BOARD A7

Transformer secondary

54. Proceed as follows:-

(1) Power up the Adapter using the mains input socket.

(2) Check for approximately 18 V AC on pin 2 with respect to ground (pin 3).

Diode bridge D1 to D4 and relay RLA

55. Proceed as follows:-

(1) Check for a DC voltage of approximately 15 V between the anode of D3 and the cathode of D4.

(2) Check the cathode of D5 for 18 V AC with respect to ground.

Bridge rectifier D5, D6 and D7 and regulator TR1 to TR3

56. Proceed as follows:-

(1) Check for approximately +23 V on TP2 with respect to TP1.

CAUTION TP1 is not at ground potential. It should be ensured that the test equipment used to take these measurements does not ground this point.

(2) Check for the following typical working voltages around TR1, TR2 and TR3 with respect to TP1:-

Transistor	Base	Emitter	Collector
TR 1	5V	4.4V	22.5V
TR 2	5V	4.4V	23V
TR 3	22.5V	23V	8.5V

Switch mode controller output and switching FETs

57. Using an oscilloscope at IC1 pin 11, IC1 pin 14, TR4 drain and TR5 drain, check for the waveforms in Fig. 5-25 and Fig. 5-26.

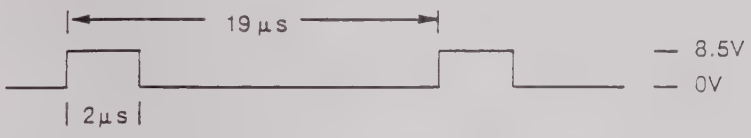

Fig. 5-25 Waveform at IC1 pins 11 and 14

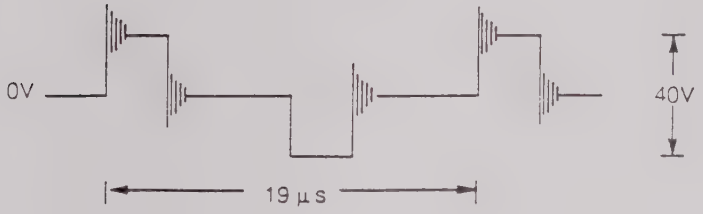

Fig. 5-26 Waveform at TR4 drain and TR5 drain

Transformer T1, rectifiers and smoothing

58. Proceed as follows:-

(1) Using an oscilloscope at D9 cathode, D12 anode and D13 cathode, check for the waveforms in Fig. 5-27, Fig. 5-28 and Fig. 5-29.

(2) Check for +12V DC on tag 4 with respect to ground at tag 5.

(3) Check for -12V DC on tag 6 with respect to ground at tag 5.

(4) Check for +5V DC on tag 7 with respect to ground at tag 5.

Note... There could be noise spikes on the supply lines of typically ±150 mV at a repetition rate of 9 µs. This is not a fault condition.

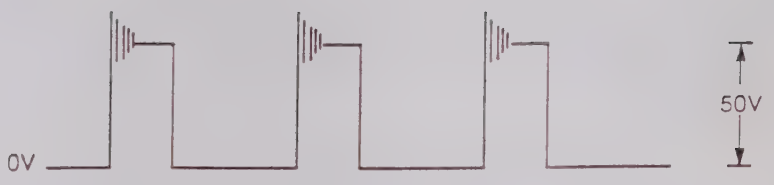

Fig. 5-27 Waveform at D9 cathode

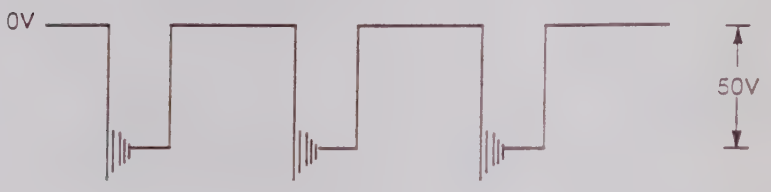

Fig. 5-28 Waveform at D12 anode

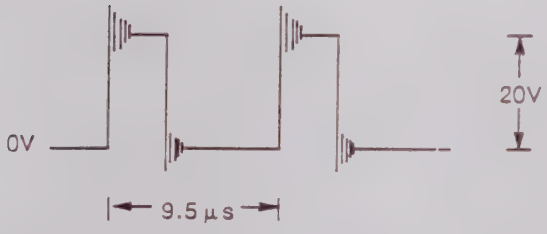

Fig. 5-29 Waveform at D13 cathode

Chapter 6

REPLACEABLE PARTS

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1	Introduction	
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10	Board A3 - Keyboard interface board	44829-162E
11	Board B4 - Personality board	44829-495H
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INTRODUCTION

1. Each sub-assembly or printed circuit board in this instrument has been allocated a unit identification, e.g. A0, AA2, AB1 etc. The complete component reference carries its unit number as a prefix e.g. AB1C3 (capacitor C3 on the mother board) but, for convenience in the text and on circuit diagrams, the prefix is not used. However, when ordering replacements or in correspondence, quote the complete component reference.

2. In MI part numbers in this Chapter, / with no check letter is used instead of - with a check letter. This is only because of the conventions of the computer system for component order processing. Either style is acceptable for orders.

COMPONENT VALUES

3. One or more of the components fitted in this instrument may differ from those listed in this chapter for any of the following reasons:

(a) Components indicated by a * have their values selected during test to achieve particular performance limits.

(b) Owing to supply difficulties, components of different value or type may be substituted provided the overall performance of the instrument is maintained.

(c) As part of a policy of continuous development, components may be changed in value or type to obtain detail improvements in performance.

When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value as found in the instrument.

MANUFACTURERS' PART NUMBERS

4. To assist you in obtaining replacements, components are listed with both a Marconi Instruments (MI) part number and a manufacturer's part number. The manufacturer can be identified by the 5-character Mfr, code which is cross-referenced to the manufacturer's name and address in Table 1.

5. Mfr. codes with four digits and a prefix letter are NSCM codes (Nato Supply codes for Manufacturers). Those with five digits are FSCM codes (Federal Supply Codes for Manufacturers) which are assigned to North American suppliers.

ORDERING

6. When ordering replacements, address the order to the Service Division (address on rear cover) or nearest agent and specify the following for each component required:

(1) Type* and serial number of equipment.

(2) Complete circuit reference.

(3) Description.

(4) Marconi Instruments Part number.

*As given on the serial number label at the rear of the instrument; if this is superseded by a model number label, quote the model number instead of the type number.

ELECTRONIC COMPONENTS

See pages 6-3 to 6-39.

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Unit AO		- Overall assembly		
7. When ordering, prefix circuit reference with AO.				
	54415/005	Complete unit	U2632	54415/005
	43137/221	CABLE COAX 225 MM LONG	U2632	43137/221
	43137/222	CABLE COAX 255 MM LONG	U2632	43137/222
	43137/223	CABLE COAX 325 MM LONG	U2632	43137/223
FS1	23411/055	FUSE TIME-LAG 250mA RATING, 20mm LONG x 5mm DIA	U0154	L2081
FS2	23411/055	FUSE TIME-LAG 250mA RATING, 20mm LONG x 5mm DIA	U0154	L2081
	23416/192	FUSEHOLDER PANEL-MTG 20 X 5MM 6.3A (MAX), 250V	U0928	F396 1 OR F455/S
PLA	23423/150	CONNECTOR MAINS R.F.FILTER ASSEMBLY, 3 WAY- MALE,	U0928	PS620/1/6AMP/ST
SA	23462/265	SWITCH TOGGLE, DOUBLE-POLE CHANGEOVER, 250V 3A	U3627	46206 LE
SKA	23424/168	CONNECTOR MAINS SOCKET SNAP-IN, 3 WAY, FEMALE, 6A	U0928	PX0780/28
R1	24784/001	RESISTOR FIXED METAL-TAPE OR01 +/- 5% 2.4W 100V	KN 350-8 R01	
T1	43490/108	TRANSFORMER ASSEMBLY	U2632	43490/108

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1	- Motherboard			
8. When ordering, prefix circuit reference with A1.				
	44829/157	Complete board	U2632	44829/157
BT1	23722/110	BATTERY PRIMARY 1 CELL 3V LITHIUM-COPPER-OXIDE 0.4		
C2	26421/019	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 100uF +/-20% 10V RADIAL: 3.5mm -(TAPED)	U3613	ECE A 10M100R
C3	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C4	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C5	26538/565	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 120pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C6	26421/019	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 100uF +/-20% 10V RADIAL: 3.5mm -(TAPED)	U3613	ECE A 10M100R
C7	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1002 AAK
C8	26343/494	CAPACITOR FIXED CERAMIC SINGLELAYER 33pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34339
C9	26582/430	CAPACITOR FIXED PLASTIC (PETP) 220nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 2203 AAK
C10	26538/912	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 2.7nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 8 2702
C11	26538/926	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 10nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1003
C12	26343/435	CAPACITOR FIXED CERAMIC SINGLELAYER 220pF +/-2% 63V N750 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 58221
C13	26538/926	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 10nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1003
C14	26582/439	CAPACITOR FIXED PLASTIC (PETP) 680nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 CC 6803 AAK
C15	26343/437	CAPACITOR FIXED CERAMIC SINGLELAYER 100pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34101
C16	26343/437	CAPACITOR FIXED CERAMIC SINGLELAYER 100pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34101
C17	26343/437	CAPACITOR FIXED CERAMIC SINGLELAYER 100pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34101
C18	26538/565	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 120pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C19	26582/428	CAPACITOR FIXED PLASTIC (PETP) 47nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 4702 AAK
C20	26538/660	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 750pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C21	26343/497	CAPACITOR FIXED CERAMIC SINGLELAYER 12pF +/-2% 63V NP0 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 10129

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
C22	26538/660	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 750pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C23	26343/432	CAPACITOR FIXED CERAMIC SINGLELAYER 150pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K8996	2222 678 34151
C24	26538/660	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 750pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C25	26538/532	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 75pF +/-2% 63V 150 ppm/DEG.C RADIAL: 7.6mm -(TAPED)	K4642	EXFS RP1
C26	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C27	26343/497	CAPACITOR FIXED CERAMIC SINGLELAYER 12pF +/-2% 63V NP0 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 10129
C28	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C29	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C30	26878/407	CAPACITOR VARIABLE PLASTIC 2pF to 22pF 100V 9mm DIA GREEN	K8996	2222 808 11229
C31	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C33	26582/439	CAPACITOR FIXED PLASTIC (PETP) 680nF +/-1J% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 CC 6803 AAK
C101	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C102	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C103	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C104	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C105	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C106	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C107	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C108	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C109	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C110	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C111	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C112	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard		(Contd.)
C113	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C114	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C115	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C116	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C117	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C118	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C119	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C120	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C121	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C122	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C123	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C124	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C125	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C126	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C127	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C128	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C129	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C130	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C131	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C132	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C133	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C134	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
C135	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C136	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C137	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C138	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C139	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C140	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C141	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C142	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C143	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C144	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C145	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C150	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C151	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C152	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C153	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C154	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C155	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C156	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C157	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C158	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C159	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C160	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C161	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
C162	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN R F0605
C163	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C164	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C165	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C166	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
D1	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D3	28349/014	DIODE SCHOTTKY BAT29... 100mW 5V 0.55Vf @ 10mA SMALL-SIGNAL, AXIAL:-DO-35. -(TAPED)	K6791	BAT 29 OR BAR 35
D4	28349/014	DIODE SCHOTTKY BAT29... 100mW 5V 0.55Vf @ 10mA SMALL-SIGNAL, AXIAL:-DO-35. -(TAPED)	K6791	BAT 29 OR BAR 35
D5	28371/371	DIODE ZENER BZX79-C4V7... 500mW 4.7V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 C4V7
D6	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D7	28371/417	DIODE ZENER BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 DC5V6
D8	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
IC1	28469/415	IC MICRO PROCESSOR 8 BIT. P8085A-2... N-CHANNEL NMOS. 40 PIN, DUAL-IN-LINE.	U4794	UPD8085AC-2
IC2	28462/410	IC DIGITAL LATCH 74LS373... OCTAL. TRANSPARENT TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS373N
IC3	28462/410	IC DIGITAL LATCH 74LS373... OCTAL. TRANSPARENT TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS373N
IC4	28462/410	IC DIGITAL LATCH 74LS373... OCTAL. TRANSPARENT TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS373N
IC5	28469/188	IC DIGITAL TRANSCEIVER 74LS245.. OCTAL. BUS, TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS245N
IC6	28465/029	IC DIGITAL DECODER/DEMULTIPLEX. 74LS139.. DUAL. 2-TO-4 LINE. TTL-(SCHOTTKY-L.PWR) 16 PIN,	K5519	SN74LS139N
IC7)				
IC8)	44533/231	EPROM KIT (MOTHERBOARD)	U2632	44533/231
IC9	28465/027	IC DIGITAL DECODER/DEMULTIPLEX. 74LS138.. 3 TO 8 LINE. TTL-(SCHOTTKY-L.PWR) 16 PIN, DUAL-IN-LINE.	K5519	SN74LS138N
IC10	28465/027	IC DIGITAL DECODER/DEMULTIPLEX. 74LS138.. 3 TO 8 LINE. TTL-(SCHOTTKY-L.PWR) 16 PIN, DUAL-IN-LINE.	K5519	SN74LS138N
IC11	28469/317	IC MICRO STATIC-RAM 8K x 8 BIT. 5565PL-15... 150nS LOW POWER. CMOS. 28 PIN, DUAL-IN-LINE.	U4794	UPD 4364C-15L(ONLY)
IC12	28467/012	IC MICRO PERIPHERAL 8259A... PROGRAMMABLE INTERRUPT. NMOS. 28 PIN, DUAL-IN-LINE.	K7664	M5L8259AP

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
IC13	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS00N
IC14	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS00N
IC15	28462/410	IC DIGITAL LATCH 74LS373... OCTAL. TRANSPARENT TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS373N
IC16	28469/188	IC DIGITAL TRANSCEIVER 74LS245.. OCTAL. BUS, TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS245N
IC17	28467/025	IC MICRO CONTROLLER 7210... INTERFACE BUS TALK/LISTEN/CONTROL. NMOS. 40 PIN, DUAL-IN-LINE.	U4794	UPD7210
IC18	28469/114	IC DIGITAL TRANSCEIVER 75160... OCTAL. GPIB DATA. TTL-(SCHOTTKY-L.PWR) 20 PIN, DUAL-IN-LINE.	K0461	SN75160AN OR BN
IC19	28469/115	IC DIGITAL TRANSCEIVER 75161... OCTAL. GPIB-CONTROLLER. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K0461	SN75161AN OR BN
IC20	28467/037	IC MICRO CONTROLLER 8254-2... PROGRAMMABLE INTERVAL TIMER 10MHz HMOS. 24 PIN, DUAL-IN-LINE.	U1425	P8254-2[D,QP,QD]
IC21	28467/037	IC MICRO CONTROLLER 8254-2... PROGRAMMABLE INTERVAL TIMER 10MHz HMOS. 24 PIN, DUAL-IN-LINE.	U1425	P8254-2[D,QP,QD]
IC22	28469/114	IC DIGITAL TRANSCEIVER 75160... OCTAL. GPIB DATA. TTL-(SCHOTTKY-L.PWR) 20 PIN, DUAL-IN-LINE.	K0461	SN75160AN OR BN
IC23	28469/115	IC DIGITAL TRANSCEIVER 75161... OCTAL. GPIB-CONTROLLER. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K0461	SN75161AN OR BN
IC24	28467/025	IC MICRO CONTROLLER 7210... INTERFACE BUS TALK/LISTEN/CONTROL. NMOS. 40 PIN, DUAL-IN-LINE.	U4794	UPD7210
IC25	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC26	28469/734	IC ANALOGUE MULTIPLEXER DG528... 8 CHANNEL BI-DIRECTIONAL. CMOS. 18 PIN, DUAL-IN-LINE.	K7068	DG528AK OR BK
IC27	28469/734	IC ANALOGUE MULTIPLEXER DG528... 8 CHANNEL BI-DIRECTIONAL. CMOS. 18 PIN, DUAL-IN-LINE.	K7068	DG528AK OR BK
IC28	28469/428	IC ANALOGUE D/A-CONVERTER 7528... DUAL. 8 BIT BUFFERED MULTIPLYING. CMOS. 20 PIN, DUAL-IN-LINE.	K7284	AD7528JN
IC29	28466/459	IC DIGITAL INVERTER 74F04..... HEX. TTL-(FAST/SCHOTTKY). 14 PIN, DUAL-IN-LINE.	K6559	74F04PC
IC30	28466/108	IC DIGITAL OR-GATE 74LS32... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS32N
IC32	28469/182	IC DIGITAL BUFFER/LINE-DRIVER 74LS244... OCTAL. TRI-STATE, LOW ENABLE. TTL-(SCHOTTKY-L.PWR) 20	K5519	SN74LS244N
IC33	28469/146	IC DIGITAL BUFFER/LINE-DRIVER 74F240... OCTAL. TRI-STATE, INVERTING. TTL-(FAST/SCHOTTKY). 20 PIN,	K6559	74F240PC
IC31	28467/051	IC MICRO CONTROLLER WD1770... FLOPPY DISC FORMATTER (5.1/4"). MOS/LSI. 28 PIN, DUAL-IN-LINE.	52840	WD1770
IC34	28469/189	IC MICRO CONTROLLER 8251A... UNIVERSAL SYN/ASYN. RECEIVER/TRANSMITTER 28 PIN, DUAL-IN-LINE.	U1458	P8251A
IC35	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS00N

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
IC36	28469/165	IC DIGITAL RECEIVER MC1489... QUAD. LINE (RS232C). TTL. 14 PIN, DUAL-IN-LINE.	K5519	MC1489L
IC37	28469/167	IC DIGITAL DRIVER MC1488... QUAD. LINE (RS232C). TTL. 14 PIN, DUAL-IN-LINE.	K5519	MC1488L
IC38	28466/108	IC DIGITAL OR-GATE 74LS32... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS32N
IC39	28469/145	IC DIGITAL TRANSCEIVER 74LS651... OCTAL. BUS TRI-STATE. TTL-(SCHOTTKY-L.PWR) 24 PIN,	K0461	SN74LS651NT
IC40	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC41	28462/410	IC DIGITAL LATCH 74LS373... OCTAL. TRANSPARENT TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS373N
IC42	28469/114	IC DIGITAL TRANSCEIVER 75160... OCTAL. GPIB DATA. TTL-(SCHOTTKY-L.PWR) 20 PIN, DUAL-IN-LINE.	K0461	SN75160AN OR BN
IC43	28469/192	IC DIGITAL TRANSCEIVER 3446... QUAD. INTERFACE BUS OPEN COLLECTOR. TTL. 16 PIN, DUAL-IN-LINE.	K5519	MC3446AP
IC44	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC45	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC46	28461/347	IC ANALOGUE OPERATIONAL AMP. TL071CP... SINGLE. JFET-INPUT LINEAR. 8 PIN, DUAL-IN-LINE.	K5519	TL071CP
IC47	28461/317	IC ANALOGUE OPERATIONAL AMP. NE531... HIGH SLEW RATE, LINEAR. 8 PIN, DUAL-IN-LINE.	U3418	RC4531[TE OR DN]
IC48	28468/404	IC DIGITAL FLIP-FLOP/MONOSTABLE 74LS221... DUAL. SCHMITT TRIGGER INPUT. TTL-(SCHOTTKY-L.PWR) 16	K5519	SN74L221N
IC49	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC50	28461/348	IC ANALOGUE OPERATIONAL AMP. TL072CP... DUAL. JFET-INPUT, LINEAR. 8 PIN, DUAL-IN-LINE.	K5519	TL072CP
IC51	28464/008	IC DIGITAL COUNTER 4017..... DECADE (+10 DEC O/P) SYNCHRONOUS BURNT-IN CMOS. 16 PIN, DUAL-IN-LINE.	K6659	4017BCPQR
IC52	28461/917	IC ANALOGUE PHASE-LOCKED-LOOP 4046.... SINGLE. TYP. Vco OPERATING FREQUENCY:1.3MHz, CMOS. 16 PIN,	K6659	4046PC
IC53	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC54	28461/374	IC ANALOGUE OPERATIONAL AMP. OP-07C... ULTRA LOW OFFSET VOLTAGE 150uV. 8 PIN, DUAL-IN-LINE.	K7284	AD OP-07DCN
IC55	28461/374	IC ANALOGUE OPERATIONAL AMP. OP-07C... ULTRA LOW OFFSET VOLTAGE 150uV. 8 PIN, DUAL-IN-LINE.	K7284	AD OP-07DCN
IC56	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC57	28461/930	IC ANALOGUE SUPPLY-MONITOR TL7705ACP... 5V VOLTAGE SUPERVISOR. 8 PIN, DUAL-IN-LINE.	K0461	TL7705ACP

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
IC58	28469/317	IC MICRO STATIC-RAM 8K x 8 BIT. 5565PL-15... 150nS LOW POWER. CMOS. 28 PIN, DUAL-IN-LINE.	U4794	UPD 4364C-15L(ONLY)
IC59	28469/171	IC DIGITAL INVERTER 74LS04... HEX. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS04N
IC60	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC61	28464/130	IC DIGITAL COUNTER 74LS393.. 4 BIT, DUAL. BINARY RIPPLE. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS393N
L1	23642/561	INDUCTOR FIXED 100uH +/- 10% LACQUERED MINIATURE AXIAL- (TAPED)	U4038	SC10 37
L2	23642/561	INDUCTOR FIXED 100uH +/- 10% LACQUERED MINIATURE AXIAL- (TAPED)	U4038	SC10 37
PLA	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
PLD	23435/965	CONNECTOR PC-BOARD HEADER, 34 WAY- MALE, RIGHT-ANGLED, 3A - FIXED-MOUNTING-PCB, 2.54mm	K0316	G08D34A8BEBA C
PLG	23435/494	CONNECTOR D-TYPE 15 WAY- FEMALE, RIGHT-ANGLED, 5A - FIXED-MOUNTING-PCB, FLOW-SOLDER TERMS. STEEL	U1718	R43 000700
PLJ	23435/911	CONNECTOR PC-BOARD WAFER, 6 WAY- MALE, STRAIGHT, 7A - TIN-PLATED. 5.08mm PITCH-	U1613	10-16-1061
R1	24773/321	RESISTOR FIXED METAL-FILM 100K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R2	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R3	24773/225	RESISTOR FIXED METAL-FILM 10R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R4	24773/225	RESISTOR FIXED METAL-FILM 10R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R5	24773/301	RESISTOR FIXED METAL-FILM 15K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R6	24773/301	RESISTOR FIXED METAL-FILM 15K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R7	24773/301	RESISTOR FIXED METAL-FILM 15K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R11	24773/321	RESISTOR FIXED METAL-FILM 100K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R12	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R13	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R14	24773/271	RESISTOR FIXED METAL-FILM 820R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R15	24773/271	RESISTOR FIXED METAL-FILM 820R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R16	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
R17	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R18	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R19	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R20	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R21	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R22	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R23	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R24	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R25	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R26	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R27	24723/403	RESISTOR FIXED METAL-FILM 1K +/- 0.1% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R28	24753/345	RESISTOR FIXED METAL-FILM 24K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R29	24773/280	RESISTOR FIXED METAL-FILM 2K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R30	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R31	24773/346	RESISTOR FIXED METAL-FILM 1M +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U2453	LR1 OR PR1
R32	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R33	24773/287	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R34	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R35	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R36	24773/290	RESISTOR FIXED METAL-FILM 5K1 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R37	24773/288	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R38	24773/288	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
R39	24773/299	RESISTOR FIXED METAL-FILM 12K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R40	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R41	25711/642	RESISTOR VARIABLE CERMET LINEAR 20K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	K8479	E2A
R42	24773/335	RESISTOR FIXED METAL-FILM 390K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U2453	LR1 OR PR1
R43	24773/316	RESISTOR FIXED METAL-FILM 62K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R44	24773/304	RESISTOR FIXED METAL-FILM 20K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R45	24773/299	RESISTOR FIXED METAL-FILM 12K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R46	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R47	24773/259	RESISTOR FIXED METAL-FILM 270R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R48	24773/299	RESISTOR FIXED METAL-FILM 12K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R49	24773/304	RESISTOR FIXED METAL-FILM 20K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R50	24773/316	RESISTOR FIXED METAL-FILM 62K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R51	24773/313	RESISTOR FIXED METAL-FILM 47K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R52	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R53	24773/328	RESISTOR FIXED METAL-FILM 200K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R54	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R55	24773/301	RESISTOR FIXED METAL-FILM 15K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R56	24773/319	RESISTOR FIXED METAL-FILM 82K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R57	24773/307	RESISTOR FIXED METAL-FILM 27K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R58	24773/251	RESISTOR FIXED METAL-FILM 120R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R59	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R60	24773/311	RESISTOR FIXED METAL-FILM 39K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R61	25711/645	RESISTOR VARIABLE CERMET LINEAR 200K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	K8479	E2A

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard		(Contd.)
R62	24773/315	RESISTOR FIXED METAL-FILM 56K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R63	24773/322	RESISTOR FIXED METAL-FILM 110K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R64	24773/318	RESISTOR FIXED METAL-FILM 75K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R65	24773/306	RESISTOR FIXED METAL-FILM 24K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R66	24773/313	RESISTOR FIXED METAL-FILM 47K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R67	24773/307	RESISTOR FIXED METAL-FILM 27K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R68	24773/296	RESISTOR FIXED METAL-FILM 9K1 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R69	24773/296	RESISTOR FIXED METAL-FILM 9K1 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R70	24773/309	RESISTOR FIXED METAL-FILM 33K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R71	24773/337	RESISTOR FIXED METAL-FILM 470K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U2453	LR1 OR PR1
R72	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R73	25711/642	RESISTOR VARIABLE CERMET LINEAR 20K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	K8479	E2A
R74	24773/306	RESISTOR FIXED METAL-FILM 24K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R75	24723/403	RESISTOR FIXED METAL-FILM 1K +/- 0.1% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R76	24753/345	RESISTOR FIXED METAL-FILM 24K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R77	25372/390	RESISTOR FIXED WIRE WOUND 3K072 +/- 0.01% 250mW 300V 5 ppm/DEG.C AXIAL (TAPED)	K7215	AX250 BT
R78	25372/390	RESISTOR FIXED WIRE WOUND 3K072 +/- 0.01% 250mW 300V 5 ppm/DEG.C AXIAL (TAPED)	K7215	AX250 BT
R79	25372/384	RESISTOR FIXED WIRE WOUND 1K6 +/- 0.01% 250mW 300V 5 ppm/DEG.C AXIAL (TAPED)	K7215	AX250 BT
R80	25372/384	RESISTOR FIXED WIRE WOUND 1K6 +/- 0.01% 250mW 300V 5 ppm/DEG.C AXIAL (TAPED)	K7215	AX250 BT
R81	24723/403	RESISTOR FIXED METAL-FILM 1K +/- 0.1% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R82	25748/562	RESISTOR VARIABLE CERMET LINEAR 2K +/- 10% 500mW 200V 100 ppm/DEG.C MULTI-TURN VERTICAL-PCB 9.5mm	U4736	175 PCT 202A
R83	24753/344	RESISTOR FIXED METAL-FILM 18K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A1		- Motherboard	(Contd.)	
R84	24773/251	RESISTOR FIXED METAL-FILM 120R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R85	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R86	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R87	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R88	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R89	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R90	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R91	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R92	24773/346	RESISTOR FIXED METAL-FILM 1M +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U2453	LR1 OR PR1
R93	24773/346	RESISTOR FIXED METAL-FILM 1M +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U2453	LR1 OR PR1
R95	24773/290	RESISTOR FIXED METAL-FILM 5K1 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R97	24773/321	RESISTOR FIXED METAL-FILM 100K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R98	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
B	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
C	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
E	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
F	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
H	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
XL1	28312/104	CRYSTAL 7.68 MHz +/- 20 ppm. 30pF PARALLEL RESONANCE. 20R ESR(max). METAL HOLDER, HC-18/U	K8300	HC 18/U
XL6	28312/070	CRYSTAL 8 MHz +/- 40 ppm. SERIES RESONANCE. 30R ESR(max). METAL HOLDER, HC-18/U WIRE LEADS.	K0142	QC894 STYLE J

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A2	- Keyboard			
9. When ordering, prefix circuit reference with A2.				
	44829/158	Complete board	U2632	44829/158
D1	28624/137	LED YELLOW- SIZE T1, 3mm DIA. HLMP-1401... 2.4 Vf (Typ), 60 mA If(max). 3 mcd @ 10mA - 60 DEG.	K3464	HL MP1401
D2	28624/137	LED YELLOW- SIZE T1, 3mm DIA. HLMP-1401... 2.4 Vf (Typ), 60 mA If(max). 3 mcd @ 10mA - 60 DEG.	K3464	HL MP1401
D3	28624/137	LED YELLOW- SIZE T1, 3mm DIA. HLMP-1401... 2.4 Vf (Typ), 60 mA If(max). 3 mcd @ 10mA - 60 DEG.	K3464	HL MP1401
D4	28624/137	LED YELLOW- SIZE T1, 3mm DIA. HLMP-1401... 2.4 Vf (Typ), 60 mA If(max). 3 mcd @ 10mA - 60 DEG.	K3464	HL MP1401
R1	24773/259	RESISTOR FIXED METAL-FILM 270R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R2	24773/259	RESISTOR FIXED METAL-FILM 270R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R3	24773/259	RESISTOR FIXED METAL-FILM 270R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R4	24773/259	RESISTOR FIXED METAL-FILM 270R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
SKA	28488/171	SOCKET (PRINTED-CIRCUIT) 20 WAY, SINGLE-IN-LINE. SNAP-STRIP, WIRE-WRAP TERMINALS. POLYESTER BODY,	55322	SEP-729-SSA-20
SA	23465/301	SWITCH PUSH-BUTTON, SINGLE-POLE N/O. 500V 10mA MOMENTARY. PCB-MOUNTING-	K8214	Y41 A 00280 FP
SB	23465/301	SWITCH PUSH-BUTTON, SINGLE-POLE N/O. 500V 10mA MOMENTARY. PCB-MOUNTING-	K8214	Y41 A 00280 FP
SC	23465/301	SWITCH PUSH-BUTTON, SINGLE-POLE N/O. 500V 10mA MOMENTARY. PCB-MOUNTING-	K8214	Y41 A 00280 FP
SD	23465/301	SWITCH PUSH-BUTTON, SINGLE-POLE N/O. 500V 10mA MOMENTARY. PCB-MOUNTING-	K8214	Y41 A 00280 FP

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A3		- Keyboard interface board		
10.	When ordering, prefix circuit reference with A3			
	44829/162	Complete board	U2632	44829/162
IC1	28466/347	IC DIGITAL NAND-GATE 74LS20... 4 INPUT, DUAL. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K6659	74LS20PC
IC2	28469/194	IC DIGITAL BUFFER/LINE-DRIVER 74LS365A... HEX. TRI-STATE. TTL-(SCHOTTKY-L.PWR) 16 PIN,	K0461	SN74LS365AN
R1	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R2	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R3	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R4	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
PLA	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		
11. When ordering, prefix circuit reference with B4				
	44829/495	Complete board	U2632	44829/495
C1	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1002 AAK
C2	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C3	26538/927	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 11nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1103
C4	26538/927	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 11nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1103
C5	26538/932	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 22nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K1191	710 22000PF1%
C6	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C7	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C8	26343/494	CAPACITOR FIXED CERAMIC SINGLELAYER 33pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34339
C9	26582/432	CAPACITOR FIXED PLASTIC (PETP) 1uF +/-10% 50V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1004 AAK
C10	26582/432	CAPACITOR FIXED PLASTIC (PETP) 1uF +/-10% 50V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1004 AAK
C11	26582/432	CAPACITOR FIXED PLASTIC (PETP) 1uF +/-10% 50V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1004 AAK
C12	26421/118	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 100uF +/-20% 6.3V RADIAL: 5mm -(TAPED)	U4011	K100/6.3
C13	26582/437	CAPACITOR FIXED PLASTIC (PETP) 150nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1503 AAK
C14	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C15	26582/434	CAPACITOR FIXED PLASTIC (PETP) 15nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1502 AAK
C16	26383/593	CAPACITOR FIXED CERAMIC SINGLELAYER 1.5nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-152
C17	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C18	26383/598	CAPACITOR FIXED CERAMIC SINGLELAYER 390pF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K7584	630-51-391
C19	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NP0 RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C20	26383/582	CAPACITOR FIXED CERAMIC SINGLELAYER 470pF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-471

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board	(Contd.)	
C21	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C22	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C23	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C24	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C25	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C26	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C27	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C28	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C29	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C30	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C31	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C32	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C33	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C34	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C35	26538/932	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 22nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K1191	710 22000PF1%
C36	26343/903	CAPACITOR FIXED CERAMIC MULTILAYER 220pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A221 FAA
C37	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C38	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1002 AAK
C39	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1002 AAK
C40	26582/426	CAPACITOR FIXED PLASTIC (PETP) 10nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1002 AAK
C41	26582/432	CAPACITOR FIXED PLASTIC (PETP) 1uF +/-10% 50V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1004 AAK
C42	26582/432	CAPACITOR FIXED PLASTIC (PETP) 1uF +/-10% 50V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1004 AAK
C43	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
C44	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C45	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C46	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C47	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C48	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C49	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C50	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C51	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C52	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C53	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C54	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50v X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C55	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C56	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C57	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C58	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C59	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C60	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C61	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C62	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C63	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C64	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C65	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C66	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
C67	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C68	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C69	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C70	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C71	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C72	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C73	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C74	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C75	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C76	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C77	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C78	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C79	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C80	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C81	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C82	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C83	26538/926	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 10nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1003
C84	26538/930	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 15nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1503
C85	26538/932	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 22nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K1191	710 22000PF1%
C86	26538/932	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 22nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K1191	710 22000PF1%
C87	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C88	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C89	26538/918	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 4.7nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K4642	EXFS/HR 4700/1%

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board	(Contd.)	
C90	26538/916	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 3.9nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 8 3902
C91	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C92	26538/930	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 15nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 4 1502
C93	26343/903	CAPACITOR FIXED CERAMIC MULTILAYER 220pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A221 FAA
C94	26538/928	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 12nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K7584	2222 443 4 1203
C95	26343/903	CAPACITOR FIXED CERAMIC MULTILAYER 220pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A221 FAA
C96	26343/911	CAPACITOR FIXED CERAMIC MULTILAYER 470pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A 471 FAA
C97	26538/915	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 3.6nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 8 3602
C98	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C99	26538/916	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 3.9nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 8 3902
C100	26343/911	CAPACITOR FIXED CERAMIC MULTILAYER 470pF +/-1% 63v NPO RADIAL: 5mm -(TAPED)	U2109	SR215A 471 FAA
C101	26538/918	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 4.7nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K4642	EXFS/HR 4700/1%
C102	26538/917	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 4.3nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K7584	2222 443 4 4302
C103	26538/916	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 3.9nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K8996	2222 443 8 3902
C104	26343/911	CAPACITOR FIXED CERAMIC MULTILAYER 470pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A 471 FAA
C105	26538/925	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 9.1nF +/-1% 63V 153 ppm/DEG.C RADIAL: 7.18mm	K7584	2222 443 4 9102
C106	26343/911	CAPACITOR FIXED CERAMIC MULTILAYER 470pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A 471 FAA
C107	26538/918	CAPACITOR FIXED PLASTIC (POLYSTYRENE) 4.7nF +/-1% 63V 125 ppm/DEG.C RADIAL: 7.18mm	K4642	EXFS/HR 4700/1%
C108	26343/911	CAPACITOR FIXED CERAMIC MULTILAYER 470pF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A 471 FAA
C109	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NPO RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
C110	26582/434	CAPACITOR FIXED PLASTIC (PETP) 15nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1502 AAK
C111	26383/593	CAPACITOR FIXED CERAMIC SINGLELAYER 1.5nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-152
C112	26383/593	CAPACITOR FIXED CERAMIC SINGLELAYER 1.5nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-152

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
C113	26383/585	CAPACITOR FIXED CERAMIC SINGLELAYER 1nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-152
C114	26383/585	CAPACITOR FIXED CERAMIC SINGLELAYER 1nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-152
C115	26383/006	CAPACITOR FIXED CERAMIC SINGLELAYER 10nF -20/+80% 25V K7004 RADIAL: 5mm -(TAPED)	K1439	SDPN RF0605
C116	26343/494	CAPACITOR FIXED CERAMIC SINGLELAYER 33pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34339
C117	26346/120	CAPACITOR FIXED CERAMIC MULTILAYER 10nF +/-20% 50V X7R AXIAL: -(TAPED)	U2109	MA10 5C103 MAA
C118	26582/429	CAPACITOR FIXED PLASTIC (PETP) 100nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1003 AAK
C119	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C120	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C121	26383/585	CAPACITOR FIXED CERAMIC SINGLELAYER 1nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-102
C122	26343/494	CAPACITOR FIXED CERAMIC SINGLELAYER 33pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K7584	2222 678 34339
C123	26343/919	CAPACITOR FIXED CERAMIC MULTILAYER 1nF +/-1% 63V NP0 RADIAL: 5mm -(TAPED)	U2109	SR215A102FAA
D1	28371/401	DIODE ZENER BZX79-C5V1... 500mW 5.1V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 C5V1
D2	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D3	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D4	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D5	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D6	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D7	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D8	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D9	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D10	28371/757	DIODE ZENER BZX79-C9V1... 500mW 9.1V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 C9V1
D11	28371/757	DIODE ZENER BZX79-C9V1... 500mW 9.1V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 C9V1

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
IC9	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC10	28467/544	IC DIGITAL SHIFT-REGISTER 74HCT4015... 4 BIT, DUAL. SERIAL-IN PARALLEL-OUT. CMOS-(H/SPEED+TTL).	K7584	PC74HCT4015P
IC11	28469/459	IC DIGITAL MODEM FX419J... FFSK 1200 BAUD. CMOS. 22 PIN, DUAL-IN-LINE.	U0394	FX419J
IC12	28461/938	IC ANALOGUE FILTER MF10CCN... DUAL. SWITCHED CAPACITOR, ACTIVE. CMOS. 20 PIN, DUAL-IN-LINE.	K7093	MF10CCN
IC13	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC14	28461/693	IC ANALOGUE VOLTAGE-COMPARATOR LM339N... QUAD. LINEAR, MONOLITHIC. 14 PIN, DUAL-IN-LINE.	K5519	LM339N
IC15	28469/410	IC DIGITAL MODEM 14412... LOW-SPEED, 600 BAUD. MOS. 16 PIN, DUAL-IN-LINE.	K5519	MC14412VP
IC16	28461/917	IC ANALOGUE PHASE-LOCKED-LOOP 4046.... SINGLE. TYP. Vco OPERATING FREQUENCY:1.3MHz, CMOS. 16 PIN,	K6659	4046PC
IC17	44535/075	PROGRAMMABLE IC FSK/MANCHESTER MODEM LOGIC ARRAY	U2632	44535/075
IC18	28467/037	IC MICRO CONTROLLER 8254-2... PROGRAMMABLE INTERVAL TIMER 10MHz HMOS. 24 PIN, DUAL-IN-LINE.	U1425	P82254-2[D,QP,QD]
IC19	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD. TTL-(SCHOTTKY-L.PWR) 14 PIN, DUAL-IN-LINE.	K5519	SN74LS00N
IC20	28466/459	IC DIGITAL INVERTER 74F04..... HEX. TTL-(FAST/SCHOTTKY). 14 PIN, DUAL-IN-LINE.	K6559	74F04PC
IC21	28461/962	IC ANALOGUE DTMF-RECEIVER 8870... LOW-POWER. CMOS. 18 PIN, DUAL-IN-LINE.	K0467	MV 8870DPL
IC22	44535/076	PROGRAMMABLE IC MODEM/USART I/FACE LOGIC ARRAY	U2632	44535/075
IC23	28469/189	IC MICRO CONTROLLER 8251A... UNIVERSAL SYN/ASYN. RECEIVER/TRANSMITTER 28 PIN, DUAL-IN-LINE.	U1458	P8251A
IC24	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC25	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC26	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC27	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC28	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC29	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC30	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ
IC31	28461/936	IC ANALOGUE SWITCH DG211CJ.... QUAD. SPST. CMOS. 16 PIN, DUAL-IN-LINE.	K7068	DG211CJ

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
IC32	44535/077	PROGRAMMABLE IC ADDRESS DECODER LOGIC ARRAY	U2632	44535/075
IC33	28469/188	IC DIGITAL TRANSCEIVER 74LS245.. OCTAL. BUS, TRI-STATE. TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS245N
IC34	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC35	28465/027	IC DIGITAL DECODER/DEMULTIPLEX. 74LS138.. 3 TO 8 LINE. TTL-(SCHOTTKY-L.PWR) 16 PIN, DUAL-IN-LINE.	K5519	SN74LS138N
IC36	28465/027	IC DIGITAL DECODER/DEMULTIPLEX. 74LS138.. 3 TO 8 LINE. TTL-(SCHOTTKY-L.PWR) 16 PIN, DUAL-IN-LINE.	K5519	SN74LS138N
IC37	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC38	28462/615	IC DIGITAL FLIP-FLOP/D-TYPE 74LS273... OCTAL. POS. EDGE TRIGGER, TTL-(SCHOTTKY-L.PWR) 20 PIN,	K5519	SN74LS273N
IC39	44535/078	PROGRAMMABLE IC BUFFER/IDENTITY LOGIC ARRAY	U2632	44535/075
IC40	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC41	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC42	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC43	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC44	28461/348	IC ANALOGUE OPERATIONAL AMP. TL072CP... DUAL. JFET-INPUT, LINEAR. 8 PIN, DUAL-IN-LINE.	K5519	TL072CN
R1	24772/126	RESISTOR FIXED METAL-FILM 160K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R2	24772/094	RESISTOR FIXED METAL-FILM 7K5 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R3	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R4	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R5	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R8	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R9	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R10	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R11	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R12	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R13	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R14	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R15	24772/130	RESISTOR FIXED METAL-FILM 240K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R16	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R17	24772/108	RESISTOR FIXED METAL-FILM 30K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R18	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R19	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R20	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R21	24772/103	RESISTOR FIXED METAL-FILM 18K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R22	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R23	24772/100	RESISTOR FIXED METAL-FILM 13K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R24	24773/266	RESISTOR FIXED METAL-FILM 510R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R25	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R26	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R27	24772/114	RESISTOR FIXED METAL-FILM 51K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R28	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R29	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R30	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R31	24772/123	RESISTOR FIXED METAL-FILM 120K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R32	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R33	25711/642	RESISTOR VARIABLE CERMET LINEAR 20K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	K8479	E2A
R34	25711/643	RESISTOR VARIABLE CERMET LINEAR 50K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	U0914	E2A
R35	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R36	24772/118	RESISTOR FIXED METAL-FILM 75K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R37	24772/123	RESISTOR FIXED METAL-FILM 120K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R38	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R39	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R40	24772/110	RESISTOR FIXED METAL-FILM 36K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R41	24772/112	RESISTOR FIXED METAL-FILM 43K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R42	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R43	24772/071	RESISTOR FIXED METAL-FILM 820R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R45	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R46	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R47	24772/132	RESISTOR FIXED METAL-FILM 300K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R48	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R49	24772/117	RESISTOR FIXED METAL-FILM 68K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R50	25711/643	RESISTOR VARIABLE CERMET LINEAR 50K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	U0914	E2A
R51	24772/119	RESISTOR FIXED METAL-FILM 82K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R52	24772/131	RESISTOR FIXED METAL-FILM 270K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R53	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R54	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R55	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R56	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R57	24772/118	RESISTOR FIXED METAL-FILM 75K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R58	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R59	24772/114	RESISTOR FIXED METAL-FILM 51K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R60	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R61	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R62	24772/133	RESISTOR FIXED METAL-FILM 330K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R63	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R64	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R65	24772/136	RESISTOR FIXED METAL-FILM 430K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R66	25711/642	RESISTOR VARIABLE CERMET LINEAR 20K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	K8479	E2A
R67	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R68	24772/136	RESISTOR FIXED METAL-FILM 430K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R69	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R70	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R71	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R72	24772/091	RESISTOR FIXED METAL-FILM 5K6 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R73	24772/086	RESISTOR FIXED METAL-FILM 3K6 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R74	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R75	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R76	24772/123	RESISTOR FIXED METAL-FILM 120K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R77	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R78	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R79	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R80	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R81	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R82	24772/114	RESISTOR FIXED METAL-FILM 51K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R83	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R84	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R85	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R86	24772/137	RESISTOR FIXED METAL-FILM 470K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R87	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R88	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R89	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R90	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R91	24772/138	RESISTOR FIXED METAL-FILM 560K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R92	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R93	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R94	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R95	24772/138	RESISTOR FIXED METAL-FILM 560K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R96	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R97	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R98	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R99	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R100	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R101	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R102	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R103	24772/098	RESISTOR FIXED METAL-FILM 11K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R104	24772/086	RESISTOR FIXED METAL-FILM 3K6 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R105	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R106	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R107	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R108	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R109	24772/093	RESISTOR FIXED METAL-FILM 6K8 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R110	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R111	24772/108	RESISTOR FIXED METAL-FILM 30K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R112	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R113	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R114	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R115	24772/077	RESISTOR FIXED METAL-FILM 1K5 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R116	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R117	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R118	24772/108	RESISTOR FIXED METAL-FILM 30K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R119	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R120	24772/071	RESISTOR FIXED METAL-FILM 820R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R121	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R122	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R123	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R124	24772/129	RESISTOR FIXED METAL-FILM 220K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R125	24772/126	RESISTOR FIXED METAL-FILM 160K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R126	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board		(Contd.)
R127	24772/133	RESISTOR FIXED METAL-FILM 330K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R128	24772/127	RESISTOR FIXED METAL-FILM 180K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R129	24772/127	RESISTOR FIXED METAL-FILM 180K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R130	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R131	24772/124	RESISTOR FIXED METAL-FILM 130K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R132	24772/126	RESISTOR FIXED METAL-FILM 160K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R133	24753/212	RESISTOR FIXED METAL-FILM 210K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R134	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R135	24753/386	RESISTOR FIXED METAL-FILM 33K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R136	24753/663	RESISTOR FIXED METAL-FILM 20K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R137	24772/095	RESISTOR FIXED METAL-FILM 8K2 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R138	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R139	24753/211	RESISTOR FIXED METAL-FILM 47K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R140	24753/629	RESISTOR FIXED METAL-FILM 12K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R141	24772/140	RESISTOR FIXED METAL-FILM 820K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R142	24772/120	RESISTOR FIXED METAL-FILM 91K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R143	24753/378	RESISTOR FIXED METAL-FILM 90K9 +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R144	24753/210	RESISTOR FIXED METAL-FILM 37K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R145	24772/142	RESISTOR FIXED METAL-FILM 510K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R146	24753/213	RESISTOR FIXED METAL-FILM 300K +/- 0.5% 250mW 200V 50 ppm/DEG.C, AXIAL: -(TAPED)	K8479	H8
R147	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R148	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board	(Contd.)	
R149	25711/641	RESISTOR VARIABLE CERMET LINEAR 10K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	U0914	E2A
R150	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R151	24772/136	RESISTOR FIXED METAL-FILM 430K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R152	24772/137	RESISTOR FIXED METAL-FILM 470K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R153	24772/142	RESISTOR FIXED METAL-FILM 510K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R154	24772/132	RESISTOR FIXED METAL-FILM 300K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R155	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R156	24753/387	RESISTOR FIXED METAL-FILM 43K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R157	24753/386	RESISTOR FIXED METAL-FILM 33K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R158	24772/133	RESISTOR FIXED METAL-FILM 330K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R159	24772/106	RESISTOR FIXED METAL-FILM 24K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R160	24753/345	RESISTOR FIXED METAL-FILM 24K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R161	24753/663	RESISTOR FIXED METAL-FILM 20K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R162	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R163	24772/114	RESISTOR FIXED METAL-FILM 51K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R164	24753/621	RESISTOR FIXED METAL-FILM 51K1 +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R165	24753/663	RESISTOR FIXED METAL-FILM 20K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R166	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R167	24753/542	RESISTOR FIXED METAL-FILM 150K +/- 0.5% 250mW 200V 50 ppm/DEG.C AXIAL (TAPED)	K8479	H8
R168	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R169	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R170	25711/641	RESISTOR VARIABLE CERMET LINEAR 10K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	U0914	E2A
R171	24772/140	RESISTOR FIXED METAL-FILM 820K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board B4		- Personality board	(Contd.)	
R172	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R173	24772/067	RESISTOR FIXED METAL-FILM 560R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
XL1	28312/111	CRYSTAL 1.008 MHz +/- 50 ppm. 30pF PARALLEL RESONANCE. 5K ESR(max). METAL HOLDER. HC-45/U WIRE	U3022	1.008M/45U/50/100/10/30
XL2	28312/112	CRYSTAL 3.57954 MHz +/- 50 ppm. 30pF PARALLEL RESONANCE. 5K ESR(max). METAL HOLDER. HC-45/U WIRE	U3022	3.579545M/45U/50/100/10/30
XL3	28312/113	CRYSTAL 10 MHz +/- 50 ppm. 30pF PARALLEL RESONANCE. 5K ESR(max). METAL HOLDER. HC-45/U WIRE	U3022	10M/45U/50/100/10/30

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A4		- AC power supply board		
12. When ordering, prefix circuit reference with A4				
	44829/299	Complete board	U2632	44829/299
C1	26422/308	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 6800uF -10/+30% 25V CYLINDRICAL-PINS: -(LOOSE)	K4701	80D682P025KB2
C2	26422/308	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 6800uF -10/+30% 25V CYLINDRICAL-PINS: -(LOOSE)	K4701	80D682P025KB2
C3	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C4	26421/129	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 470uF +/-20% 25V RADIAL: 5mm -(LOOSE) TAPE OPTIONAL.	K8996	035 56471
C5	26421/130	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 1000uF +/-20% 35V RADIAL: 7.5mm -(LOOSE) TAPE OPTIONAL.	K8996	035 90006
C6	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C7	26383/585	CAPACITOR FIXED CERAMIC SINGLELAYER 1nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-102
C8	26421/100	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 100nF +/-20% 50V RADIAL: 5mm -(TAPED)	U4011	K 0.1/50
C9	26343/438	CAPACITOR FIXED CERAMIC SINGLELAYER 120pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K8996	2222 678 3
C10	26421/140	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 470uF +/-20% 16V RADIAL: -(LOOSE)	U2632	26421/140
C11	26421/140	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 470uF +/-20% 16V RADIAL: -(LOOSE)	U2632	26421/140
C12	26582/434	CAPACITOR FIXED PLASTIC (PETP) 15nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 1502 AAK
D1	28355/723	DIODE RECTIFIER 1N5401... 100V 3A - AXIAL:-DO-201AD. -(TAPED)	K8300	1N5401
D2	28355/723	DIODE RECTIFIER 1N5401... 100V 3A - AXIAL:-DO-201AD. -(TAPED)	K8300	1N5401
D3	28355/723	DIODE RECTIFIER 1N5401... 100V 3A - AXIAL:-DO-201AD. -(TAPED)	K8300	1N5401
D4	28355/723	DIODE RECTIFIER 1N5401... 100V 3A - AXIAL:-DO-201AD. -(TAPED)	K8300	1N5401
D5	28372/584	DIODE ZENER BZX79-C18.... 500mW 18V 5% 250mA AXIAL:-DO-35. -(TAPED)	K8996	BZX79 C18
D6	28355/164	DIODE SCHOTTKY 50SQ030... 30V 5A RECTIFIER AXIAL:-C-24. -(TAPED)	U5008	50SQ030
D7	28359/189	DIODE BRIDGE 2KBB20R... 200V 1.9A 80Vrms @ 1.9A, SINGLE-PHASE, ENCAPSULATED.	U5008	2KBB20R
FS1	23411/062	FUSE TIME-LAG 3.15A RATING. 20mm LONG x 5mm DIA. 250V A.C.	K0647	S502 OR TD123

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A4		- AC power supply board		(Contd.)
IC1	28461/708	IC ANALOGUE VOLTAGE-REGULATOR 7812... 12V 1A POSITIVE. LINEAR MONOLITHIC. 3 PIN, TO-220.	K0461	UA7812CKC
IC2	28461/718	IC ANALOGUE VOLTAGE-REGULATOR 7912... SINGLE. 12V 1A NEGATIVE. LINEAR MONOLITHIC. 3 PIN, TO-220.	K5519	MC7912CT
IC3	28461/729	IC ANALOGUE VOLTAGE-REGULATOR uA78S40... 40V SUB-SYSTEM, +/- ADJUSTABLE. MONOLITHIC. 16 PIN,	K6659	UA78S40[PC OR DC]
IC4	28383/988	DIODE VOLTAGE-SUPPRESSOR L-6-0V-5 150W 5V MONOLITHIC TO-3	K6317	L6 0V 5
L1	23642/909	CHOKE-HF WIDEBAND 2.5 TURNS 4B1	K8996	4312 020 36700
R2	24773/279	RESISTOR FIXED METAL-FILM 1K8 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R3	24773/249	RESISTOR FIXED METAL-FILM 100R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R4	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R5	24773/281	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	K8996	MR25
R6	25711/640	RESISTOR VARIABLE CERMET LINEAR 5K +/- 10% 500mW 200V 150 ppm/DEG.C SINGLE-TURN HORIZONTAL-PCB	U0914	E2A
TR1	28455/421	TRANSISTOR NPN BIPOLAR BC237A.... TO-18. 45V 150MHz 200mW 100mA 170hFE @ 2mA.	K1196	ZTX107AL
TR2	28435/227	TRANSISTOR PNP BIPOLAR BC307A.... TO-18. 45V 130MHz 200mW 100mA 180hFE @ 2mA.	K6360	BC307A
TR3	28459/056	TRANSISTOR P-CHANNEL-ENHANCE MOSFET 2SJ122.... TO-220. 60V 50W 10A 0R2	U5008	IRF 9541
Board A7		- AC/DC power supply board		
13. When ordering, prefix circuit reference with A7				
	44829/531	Complete unit	U2632	44829/531
B	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
B	23435/990	CONNECTOR JUMPER SHORTING-LINK, 2 WAY- SOCKET, FEMALE, 3A - FREE-MOUNTING, ON 0.64mm PINS, 9.6mm	U2338	65474 001
C1	26582/418	CAPACITOR FIXED PLASTIC (PETP) 2.2uF +/-10% 63V RADIAL: 15.2mm -(LOOSE)	K8283	A1B222018
C2	26582/418	CAPACITOR FIXED PLASTIC (PETP) 2.2uF +/-10% 63V RADIAL: 15.2mm -(LOOSE)	K8283	A1B222018
C3	26422/310	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 4700uF -10/+30% 50V CYLINDRICAL-PINS: -(LOOSE)	K4701	80D 472P050MB2
C4	26422/310	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 4700uF -10/+30% 50V CYLINDRICAL-PINS: -(LOOSE)	K4701	80D 472P050MB2
C5	26421/115	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 33uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K33/25

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A7		- AC/DC power supply board	(Contd.)	
C6	26421/115	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 33uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K33/25
C7	26343/437	CAPACITOR FIXED CERAMIC SINGLELAYER 100pF +/-2% 63V N150 RADIAL: 2.5mm -(TAPED)	K8996	2222 678 34101
C8	26421/115	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 33uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K33/25
C9	26421/114	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 22uF +/-20% 25V RADIAL: 5mm -(TAPED)	U4011	K22/25
C10	26383/591	CAPACITOR FIXED CERAMIC SINGLELAYER 4.7nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-472
C11	26383/591	CAPACITOR FIXED CERAMIC SINGLELAYER 4.7nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-472
C12	26582/428	CAPACITOR FIXED PLASTIC (PETP) 47nF +/-10% 63V 330 ppm/DEG.C RADIAL: 5mm -(TAPED)	K1945	R68 DC 4702 AAK
C13	26421/130	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 1000uF +/-20% 35V RADIAL: 7.5mm -(LOOSE) TAPE OPTIONAL.	K8996	035 90006
C14	26421/130	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 1000uF +/-20% 35V RADIAL: 7.5mm -(LOOSE) TAPE OPTIONAL.	K8996	035 90006
C15	26421/132	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 2200uF +/-20% 16V RADIAL: 7.5mm -(LOOSE) TAPE OPTIONAL.	K8996	035 55222
C16	26383/591	CAPACITOR FIXED CERAMIC SINGLELAYER 4.7nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-472
C17	26383/591	CAPACITOR FIXED CERAMIC SINGLELAYER 4.7nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-472
C18	26383/591	CAPACITOR FIXED CERAMIC SINGLELAYER 4.7nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-472
C19	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C20	26421/112	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 10uF +/-20% 35V RADIAL: 5mm -(TAPED)	U4011	K10/35
C21	26383/585	CAPACITOR FIXED CERAMIC SINGLELAYER 1nF +/-10% 63V Y5S RADIAL: 2.5mm -(TAPED)	K8996	630-18-102
C22	26421/106	CAPACITOR FIXED ELECTROLYTIC (ALUMINIUM) 1uF +/-20% 50V RADIAL: 5mm -(TAPED)	U4011	K1.0150
D1	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D2	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D3	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D4	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D5	28355/163	DIODE SCHOTTKY USD845... 45V 12A RECTIFIER, TO-220AC.	U2632	28355/163

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A7		- AC/DC power supply board	(Contd.)	
D6	28355/163	DIODE SCHOTTKY USD845... 45V 12A RECTIFIER, TO-220AC.	U2632	28355/163
D7	28355/165	DIODE SCHOTTKY 20CTQ045... 45V 16A DUAL RECTIFIER, TO-220AB.	U5008	20CTQ45
D8	28355/167	DIODE RECTIFIER MR810... 50V 1A 1Vf @ 1A, 100nS, CASE 59-04 AXIAL:-DO-41. -(TAPED)	K5519	MR810
D9	28356/019	DIODE RECTIFIER BYV28-200... 200V 3.5A 30nS, AXIAL: -(TAPED)	K8996	BYV28 200
D10	28356/019	DIODE RECTIFIER BYV28-200... 200V 3.5A 30nS, AXIAL: -(TAPED)	K8996	BYV28 200
D11	28356/019	DIODE RECTIFIER BYV28-200... 200V 3.5A 30nS, AXIAL: -(TAPED)	K8996	BYV28 200
D12	28356/019	DIODE RECTIFIER BYV28-200... 200V 3.5A 30nS, AXIAL: -(TAPED)	K8996	BYV28 200
D13	28355/165	DIODE SCHOTTKY 20CTQ045... 45V 16A DUAL RECTIFIER, TO-220AB.	U5008	20CTQ45
D14	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D15	28385/708	DIODE THYRISTOR BT151-500R... 500mW 500V 7.5A TO-220AB.	K7584	BT151-500R
D16	28336/676	DIODE GENERAL-PURPOSE 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL:-DO-35. -(TAPED)	K8996	1N4148
D17	28371/494	DIODE ZENER 1N825... 250mW 6.2V 5% 50mA 20ppm/DEG.C, AXIAL:-DO-35. -(TAPED)	K8996	1N825 OR A
FS1	23411/863	FUSE QUICK-ACTING 3.5A RATING. 7.1mm LONG x 2.4mm DIA. WIRE-ENDED, AXIAL.	U2632	23411/863
IC1	28461/749	IC ANALOGUE CURRENT-MODE-CONTROL UC3846N... SMPS. 16 PIN, DUAL-IN-LINE.	U2632	28461/749
IC2	28625/001	MODULE OPTO ISOLATOR- DUAL, ILD74... 8 PIN, DUAL-IN-LINE.	K5519	TL074CN
IC3	28461/349	IC ANALOGUE OPERATIONAL AMP. TL074CN... QUAD. JFET-INPUT, LINEAR. 14 PIN, DUAL-IN-LINE.	K5519	TL074CN
L1	44290/958	INDUCTOR ASSEMBLY	U2632	44290/958
L2	44290/954	INDUCTOR ASSEMBLY	U2632	44290/954
PLA	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH. PCB-MOUNTING, SINGLE-ENDED, REELED.	U2338	75401 001
R1	24772/077	RESISTOR FIXED METAL-FILM 1K5 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R2	24772/088	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R3	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A7		- AC/DC power supply board	(Contd.)	
R4	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R5	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R6	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R7	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R8	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R9	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R10	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R11	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R12	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R13	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R14	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R15	24772/112	RESISTOR FIXED METAL-FILM 43K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R16	24773/215	RESISTOR FIXED METAL-FILM 3R9 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL: -(TAPED)	U1395	RC55
R17	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R18	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R19	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R20	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R21	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R22	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R23	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R24	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R25	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51

Cct. Ref.	MI Part No.	Description	Mfr. Code	Mfr.Part No.
Board A7		- AC/DC power supply board	(Contd.)	
R26	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R27	24772/129	RESISTOR FIXED METAL-FILM 220K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	K7584	MR16 OR MR16T
R28	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R29	25711/661	RESISTOR VARIABLE CERMET LINEAR. 5K +/- 10% 500mW 200V 100 ppm/DEG.C. SINGLE-TURN. HORIZONTAL-PCB,	K0718	62MR5K
R30	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R31	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
R32	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C AXIAL (TAPED)	U0142	CMF51
RLA	23486/147	RELAY MAGNETIC, SINGLE-POLE CHANGEOVER. 24V (COIL), 1K11 - PCB-MOUNTING-	K7495	G2L 113 PV - 24 VOLT
SKA	23435/990	CONNECTOR JUMPER SHORTING-LINK, 2 WAY- SOCKET, FEMALE, 3A - FREE-MOUNTING, ON 0.64mm PINS, 9.6mm	U2338	65474 001
T1	43590/174	TRANSFORMER ASSEMBLY	U2632	43590/174
T2	43590/173	TRANSFORMER ASSEMBLY	U2632	43590/173
TR1	28455/421	TRANSISTOR NPN BIPOLAR BC237A.... TO-18. 45V 150MHz 200mW 100mA 170hFE @ 2mA.	K1196	ZTX107AL
TR2	28455/421	TRANSISTOR NPN BIPOLAR BC237A.... TO-18. 45V 150MHz 200mW 100mA 170hFE @ 2mA.	K1196	ZTX107AL
TR3	28435/428	TRANSISTOR PNP BIPOLAR BC212B.... TO-18. 50V 200MHz 300mW 60hFE @ 2mA.	K5519	BC212B
TR4	28459/069	TRANSISTOR N-CHANNEL-ENHANCE MOSFET IRF540.... TO-220. 100V 125W 27A OR085	U2632	28459/069
TR5	28459/069	TRANSISTOR N-CHANNEL-ENHANCE MOSFET IRF540.... TO-220. 100V 125W 27A OR085	U2632	28459/069
TR6	28435/428	TRANSISTOR PNP BIPOLAR BC212B.... TO-18. 50V 200MHz 300mW 60hFE @ 2mA.	K5519	BC212B

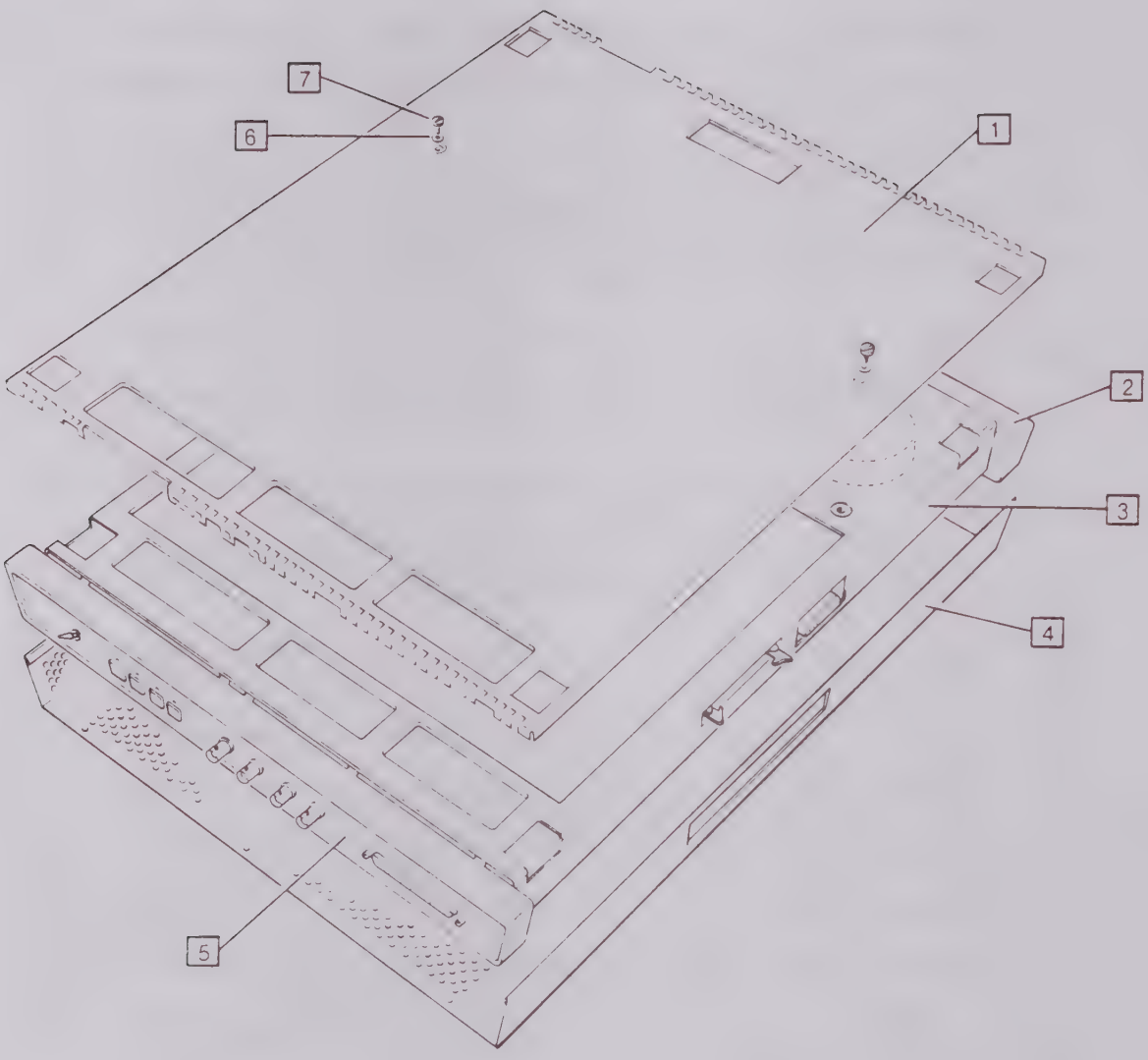

Fig. 1 Mechanical parts

Item No..	MI Part No.	Description

MECHANICAL PARTS

16. Item numbers correspond with those shown in Fig. 1.

1	35906/338	UPPER COVER
2	35905/459	REAR PANEL
3	35905/466	CHASSIS ASSY
4	35906/339	LOWER COVER
5	35905/449	FRONT PANEL
6	21177/648	WASHER METRIC CRINKLE M3 6.4 mm O/D 3.2 mm I/D
7	21837/359	SCREW METRIC PAN-HEAD SLOTTED M3 8 mm LONG STEEL

Code	Address
52840	WESTERN DIGITAL CORP, 3128 REDHILL AVE, COSTA MESA, CA92626, USA,
55322	SAMTEC INC, 810 PROGRESS BLVD, PO BOX 1147, NEW ALBANY, IN47150 3674, USA
K0142	SALFORD ELECTRICAL INSTRUMENTS LTD, NEWHAVEN INDUSTRIAL ESTATE, BARTON LANE, ECCLES, MANCHESTER, M30 0HL
K0316	ITT CANNON UK, JAYS CLOSE, VIABLES IND EST, BASINGSTOKE, HANTS, RG22 4BW
K0371	SAFT (UK) LTD, CASTLE WORKS, STATION ROAD, HAMPTON, MIDDX, TW12 2BY
K0461	TEXAS INSTRUMENTS LTD, MANTON LANE, BEDFORD, MK41 7PA
K0647	BESWICK A DIVISION OF DUBILIER PLC, ALERT WORKS, FROME, SOMERSET, BA11 1PP
K0718	BECKMAN INSTRUMENTS LTD, GLENROTHES, FIFE, SCOTLAND, KY7 5PU
K1072	GREENPAR CONNECTORS LTD, PO BOX 15, HARLOW, ESSEX, CM20 2ER
K1191	SUFLEX LTD, NEWPORT RD, RISCA, NEWPORT, GWENT, NP1 6YD
K1196	FERRANTI LTD ELECTRONICS DIVISION, GEM MILL, CHADDERTON, OLDHAM, LANCS, OL9 8NP
K1439	STETTNER (DE) STEATITE ROEDERSTEIN LTD, HAGLEY HOUSE, 83 HAGLEY ROAD, BIRMINGHAM, B16 8QW
K1945	ARCOTRONICS (SCOTLAND) LTD, WHITESIDE WORKS, BATHGATE, WEST LOTHIAN, EH48 2RL
K3464	HEWLETT-PACKARD LTD, ESKDALE ROAD, WINNERSH TRIANGLE, WOKINGHAM, BERKS, RG11 5DZ
K4642	LCR COMPONENTS, CROSS STREET, TREDEGAR, GWENT, NP2 6HA
K4701	SPRAGUE ELECTRIC (UK) LTD, AIRTECH 2, GENNER ROAD OFF FLEMING WAY, CRAWLEY, WEST SUSSEX, RH10 2YG
K5519	MOTOROLA (UK SALES) LTD, MOTOROLA SEMI-CON PRODUCTS GRP, FAIRFAX HOUSE, 69 BUCKINGHAM STREET, AYLESBURY BUCKS, HP20 2NF
K6317	LAMBDA ELECTRONICS, ABBEY BARN ROAD, HIGH WYCOMBE, BUCKS, HP11 1RW
K6360	SIEMENS LTD ELECTRONIC COMPONENTS GROUP, SIEMENS HOUSE, WINDMILL ROAD, SUNBURY ON THAMES, MIDDLESEX, TW16 7HS
K6659	FAIRCHILD SEMI CONDUCTOR LTD, 230 HIGH STREET, POTTERS BAR, HERTS, EN6 5BL

Code	Address
K6791	THOMSON CSF COMPONENTS & MATERIALS LTD, RINGWAY HOUSE, BELL ROAD, DANESHILL, BASINGSTOKE HANTS, RG24 0QG
K7068	SILICONIX LTD, LLANLLIENWEN CLOSE, MORRISTON, SWANSEA, SA6 6NE
K7093	NATIONAL SEMI CONDUCTOR (UK) LTD, 301 HARPUR CENTRE, HORNE LANE, BEDFORD, MK40 1TR
K7215	MANN COMPONENTS LTD, STATION ROAD, WYMONDHAM, NORFOLK, NR18 0RA
K7284	ANALOG DEVICES LTD, CENTRAL AVENUE, EAST MOLESEY, SURREY, KT8 0SN
K7495	IMO PRECISION CONTROLS LTD, 1000 NORTH CIRCULAR ROAD, STAPLE CORNER, LONDON, NW2 7JP
K7584	PHILIPS ELECTRONIC & ASSOC. INDS. LTD, ARUNDEL GT COURT, 8 ARUNDEL STREET, LONDON, WC2R 3DT
K7664	MITSUBISHI CORPORATION, BOW BELLS HOUSE, BREAD STREET, LONDON, EC4N 9BJ
K8214	LIPA & ISOSTAT (GB) LTD, HERON INDUSTRIAL ESTATE, 8 ROBERT WAY, WICKFORD, ESSEX, SS11 8DD
K8283	ASHCROFT ELECTRONICS LTD, 1 WILKINSON ROAD, CIRENCESTER, GLOS, GL7 1YT
K8300	STANDARD TELEPHONE & CABLES LTD, CHRISTCHURCH WAY, GREENWICH, LONDON, SE10 0AG
K8479	HOLSWORTHY ELECTRONICS LTD, NORTH ROAD, HOLSWORTHY, DEVON, EX22 6JE
K8996	MULLARD LTD, MULLARD HOUSE, TORRINGTON PLACE, LONDON, WC1E 7HD
S3323	FUJISOKU ELECTRIC CO LTD, TOKIO, JAPAN
U0142	DALE-ACI COMPONENTS LTD, SOLWAY IND ESTATE, MARYPORT, CUMBRIA, CA15 8NF
U0154	BELLING LEE LTD, INTEC HOUSE, 540 GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX, EN1 3RY
U0394	CONSUMER MICROCIRCUITS LTD, WHEATON ROAD IND. ESTATE, WITHAM, ESSEX, CM8 3TD
U0914	GENERAL HYBRID LTD, BEDE INDUSTRIAL EST, JARROW, TYNE & WEAR, NE32 3EN
U0928	BULGIN AF & CO LTD, BYE-PASS ROAD, BARKING, ESSEX, IG11 0AZ
U1425	INTEL INTERNATIONAL (UK) LTD, PIPERS WAY, SWINDON, WILTS, SN3 1RJ

Code	Address
U1458	ADVANCED MICRO DEVICES (UK) LTD, AMD HOUSE, GOLDSWORTH ROAD, WOKING, SURREY, GU21 1JT
U1613	MOLEX ELECTRONICS LTD, MOLEX HOUSE, FARNHAM ROAD, BORDEN, HANTS, GU35 0NU
U1718	TRW CONNECTORS LTD, SHIREOAKS ROAD, WORKSOP, NOTTS, S80 3HA
U2109	AVX LTD, THAMES WORKS LWR TEDDINGTON RD, HAMPTON WICK, NR KINGSTON UPON THAMES, SURREY, KT1 4HA
U2338	DUPONT (UK) LTD (BERG ELECTRONICS DIV), WEDGEWOOD WAY, STEVENAGE, HERTS, SG1 4QN
U2453	NEOHM, ITALIA HOUSE, PASS STREET, WERNETH, OLDHAM LANCS, OL9 6HZ
U2632	MARCONI INSTRUMENTS SERVICE DIVISION, THE AIRPORT, LUTON, BEDS, LU2 9NS
U3022	IQD LTD, NORTH ST, CREWKERNE, SOMERSET
U3418	RAYTHEON SEMI CONDUCTOR INTERNATL CO LTD, HARREM HOUSE, OGILVIE ROAD, HIGH WYCOMBE, BUCKS, HP12 3DS
U3613	MATSUSHITA ELECTRONICS COMPONENTS co.LTD, NATIONAL PANASONICS (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS, SL1 6JB
U3627	CANADIAN INSTRUMENTS & ELECTRONICS LTD, STATION ROAD, ILKESTON, DERBYSHIRE, DE7 5TX
U4011	WIMPEY DUBILIER LTD, CHAUCER TRADING ESTATE, LAUNTON ROAD, BICESTER, OXON, OX6 0TU
U4038	SIGMEX LTD, SIGMA HOUSE, NORTH HEATH LANE, HORSHAM, SUSSEX, RH12 4UZ
U4736	AB ELECTRONIC EQUIP LTD, IVER ROAD, SCHEFORD, BEDS, SG17 5JU
U4794	NEC ELECTRONICS (UK) LTD, SYGNES HOUSE, SUNRISE PARKWAY, MILTON KEYNES, MK14 6NP
U5008	POWER PRODUCTS INTERNATIONAL LTD, COMMERCE WAY, EDENBRIDGE, KENT, TN8 6ED

Chapter 7

SERVICING DIAGRAMS

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Para.
1 Circuit notes
2 Symbols
3 PCB layouts

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2	A1 - Motherboard (microprocessor)	44829-157Y	4	5
3	" (disc and GPIB interfaces)	"		7
4	" (serial and parallel interfaces)	"		9
5	" (analogue)	"		11
6	A2 - Keyboard	44829-158N	12	13
6	A3 - Keyboard interface board	44829-162E	12	13
7	B4 - Personality board (modems)	44829-495H	14	15
8	" (tone filters and detectors)	"		17
9	" (digital)	"		19
10	" (psophometric filters)	"		21
11	A4 - AC power supply board	44829-299G	22	23
12	A7 - AC/DC power supply board	44829-531A	24	25

CIRCUIT NOTES

Component values

1. Resistors : R = ohms, k = kilohms, M = megohms.
   Capacitors: μ = microfarads, n = nanofarads, p = picofarads.
   Inductors : μ = microhenries, m = millihenries.
   SIC : Value selected in circuit during test, nominal value shown.

Symbols

2. Symbols are to BS3939 with the following additions:

Static sensitive component - see Notes and Cautions, p. iv.

Tag.

Test point.

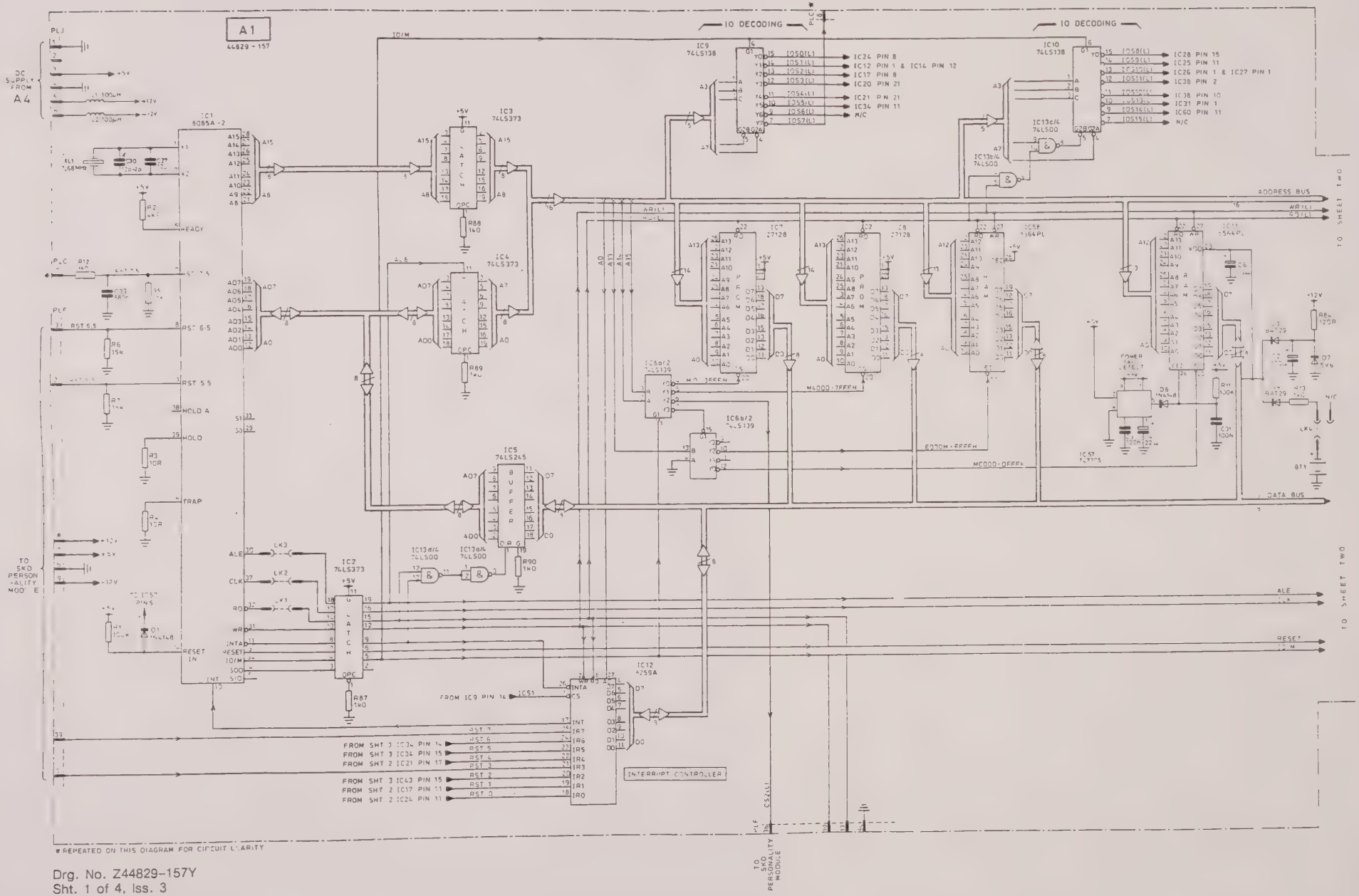
Edge connector.

Ferrite bead.

Unit identification.

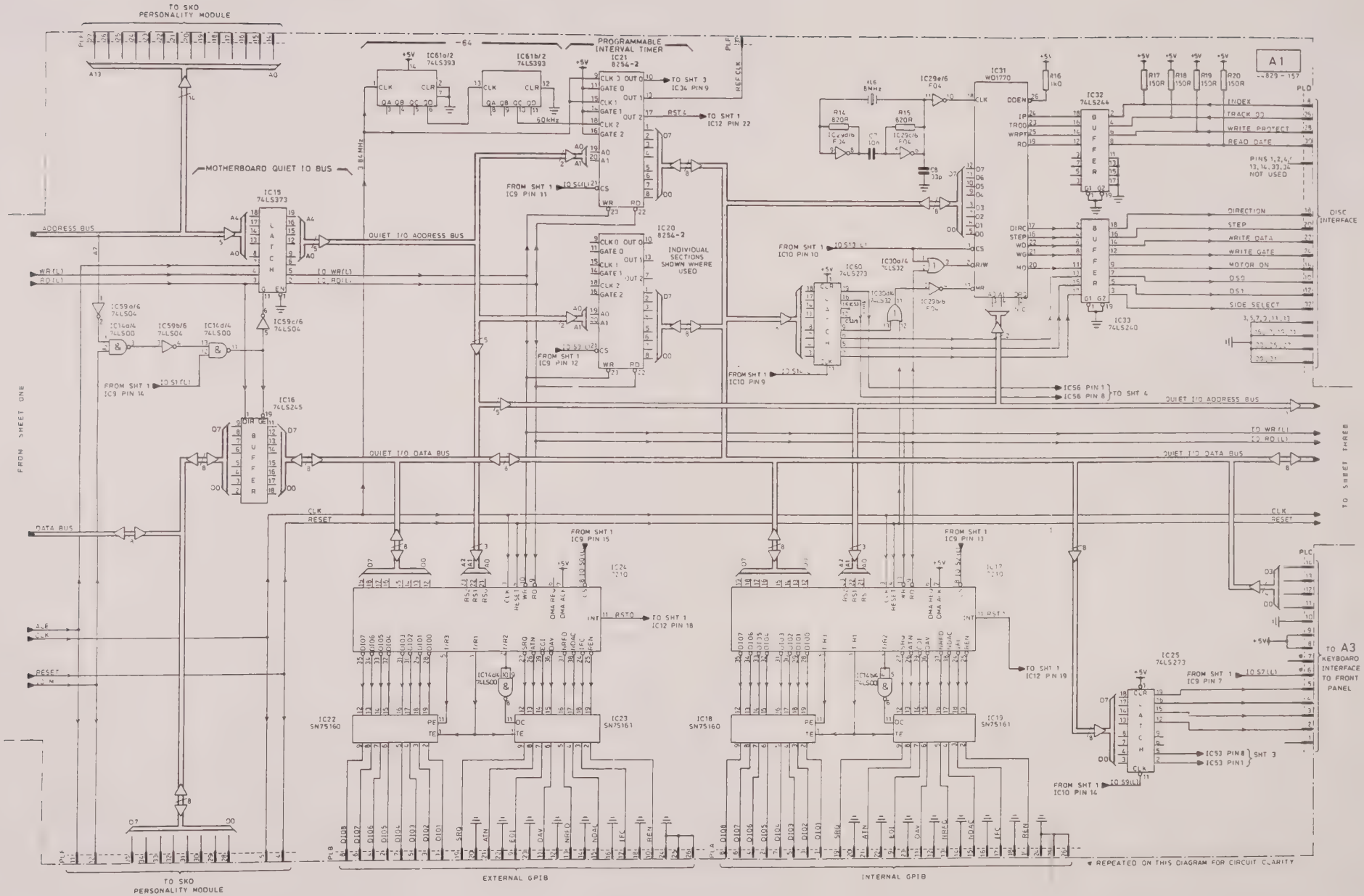
PCB layouts

3. PCB layouts are viewed from the component side.



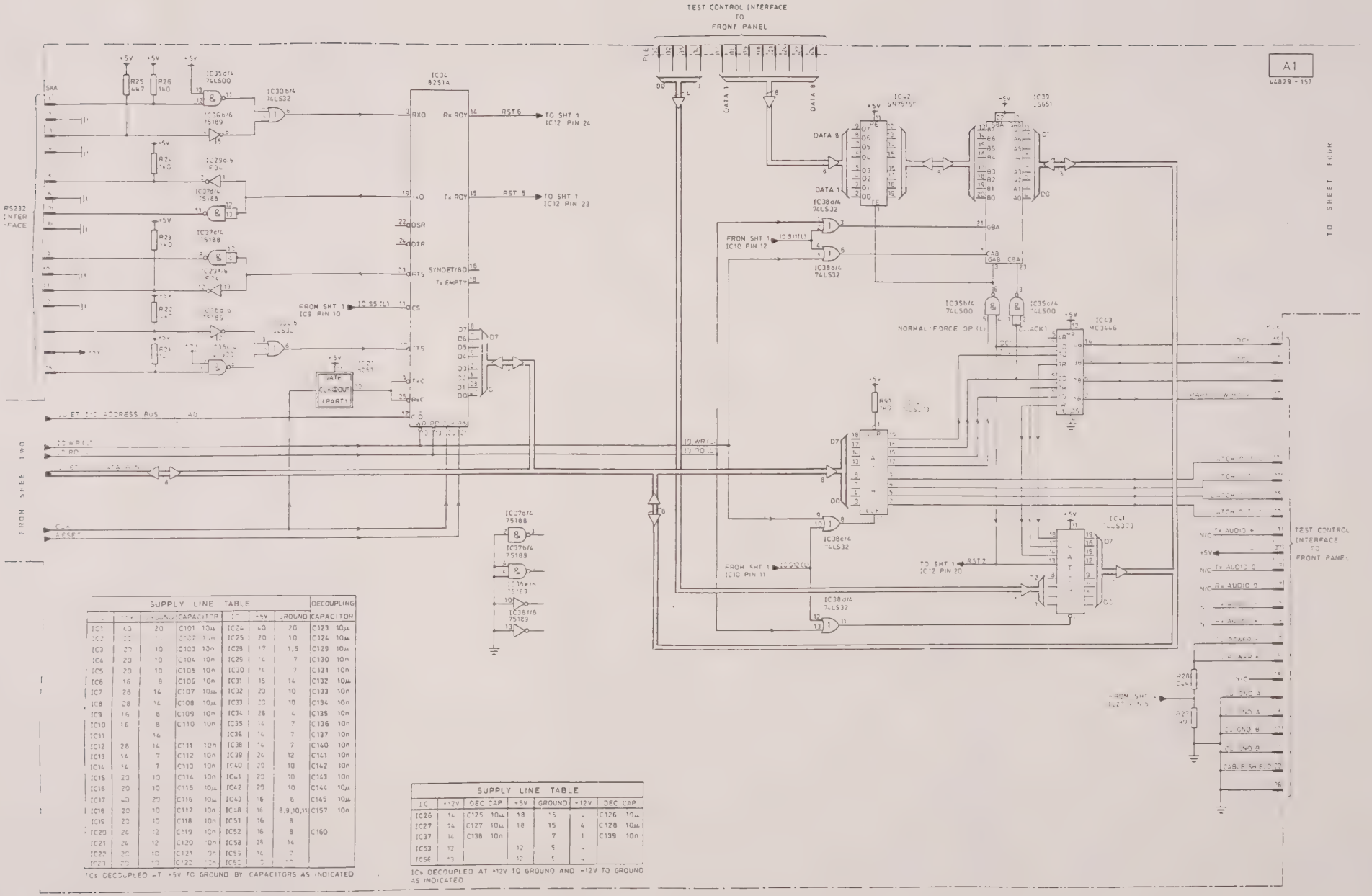
Drg. No. Z44829-157Y
Sht. 1 of 4, Iss. 3

A1 : Motherboard (microprocessor)



Drg. No. Z44829-157
Sht. 2 of 4, Iss. 4

A1 : Motherboard (interfaces)



SUPPLY LINE TABLE							DECOUPLING
IC	+5V	GROUND	CAPACITOR	IC	+5V	GROUND	CAPACITOR
IC1	40	20	C101 10µ	IC24	40	20	C123 10µ
IC2	20	-	C102 10µ	IC25	20	10	C124 10µ
IC3	20	10	C103 10n	IC28	17	1,5	C129 10µ
IC4	20	10	C104 10n	IC29	14	7	C130 10n
IC5	20	10	C105 10n	IC30	14	7	C131 10n
IC6	16	8	C106 10n	IC31	15	14	C132 10µ
IC7	28	14	C107 10µ	IC32	20	10	C133 10n
IC8	28	14	C108 10µ	IC33	20	10	C134 10n
IC9	16	8	C109 10n	IC34	26	4	C135 10n
IC10	16	8	C110 10n	IC35	14	7	C136 10n
IC11		14		IC36	14	7	C137 10n
IC12	28	14	C111 10n	IC38	14	7	C140 10n
IC13	14	7	C112 10n	IC39	24	12	C141 10n
IC14	14	7	C113 10n	IC40	20	10	C142 10n
IC15	20	10	C114 10n	IC41	20	10	C143 10n
IC16	20	10	C115 10µ	IC42	20	10	C144 10µ
IC17	40	20	C116 10µ	IC43	16	8	C145 10µ
IC18	20	10	C117 10n	IC48	16	8,9,10,11	C157 10n
IC19	20	10	C118 10n	IC51	16	8	
IC20	24	12	C119 10n	IC52	16	8	C160
IC21	24	12	C120 10n	IC58	28	14	
IC22	20	10	C121 10n	IC55	14	7	
IC23	20	10	C122 10n	IC62	2	12	

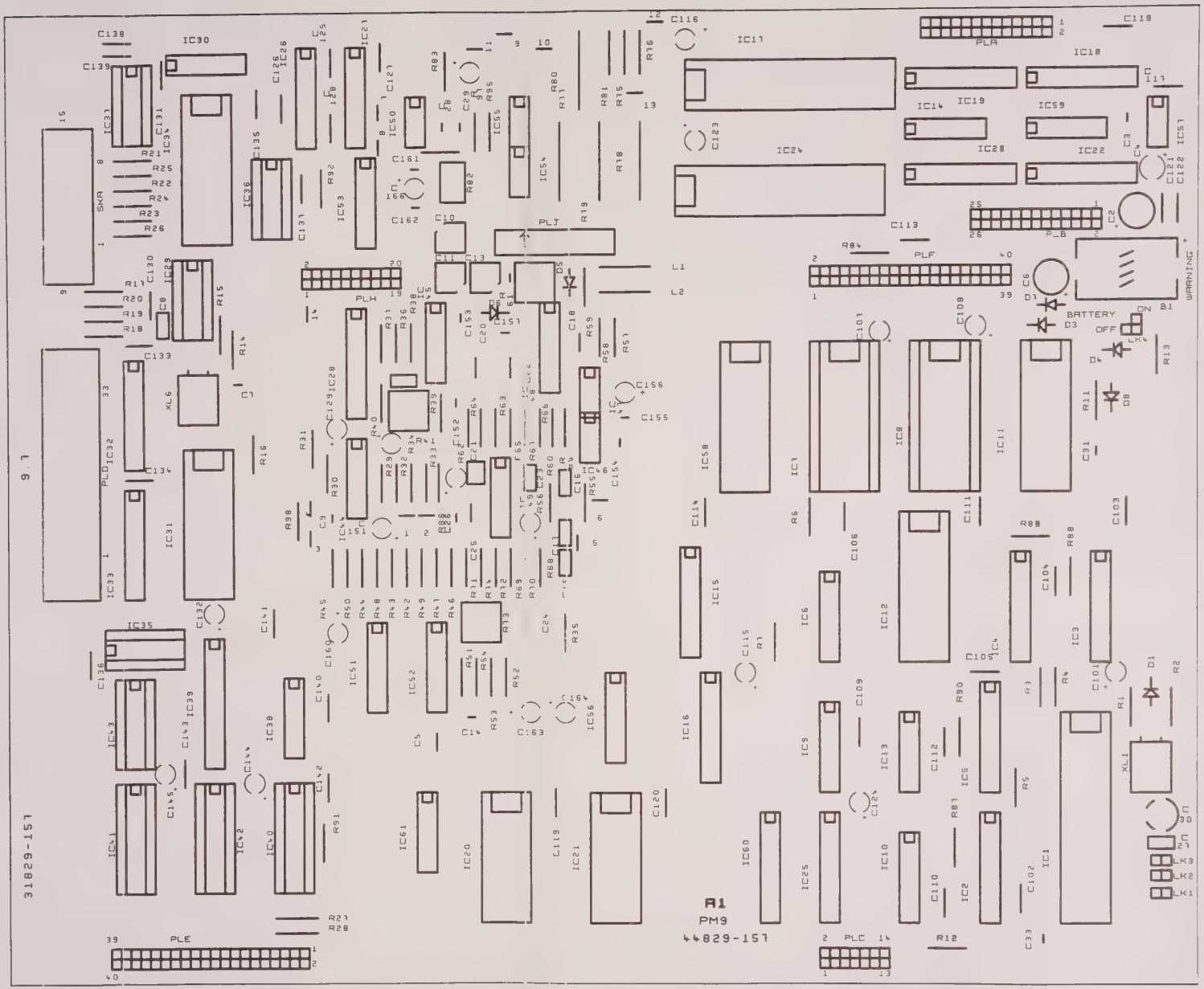
ICs DECOUPLED +T +5V TO GROUND BY CAPACITORS AS INDICATED

SUPPLY LINE TABLE						
IC	+12V	DEC CAP	+5V	GROUND	-12V	DEC CAP
IC26	14	C125 10µ	18	15	-	C126 10µ
IC27	14	C127 10µ	18	15	4	C128 10µ
IC37	14	C138 10n		7	1	C139 10n
IC53	13		12	5	-	
IC56	13		12	5	-	

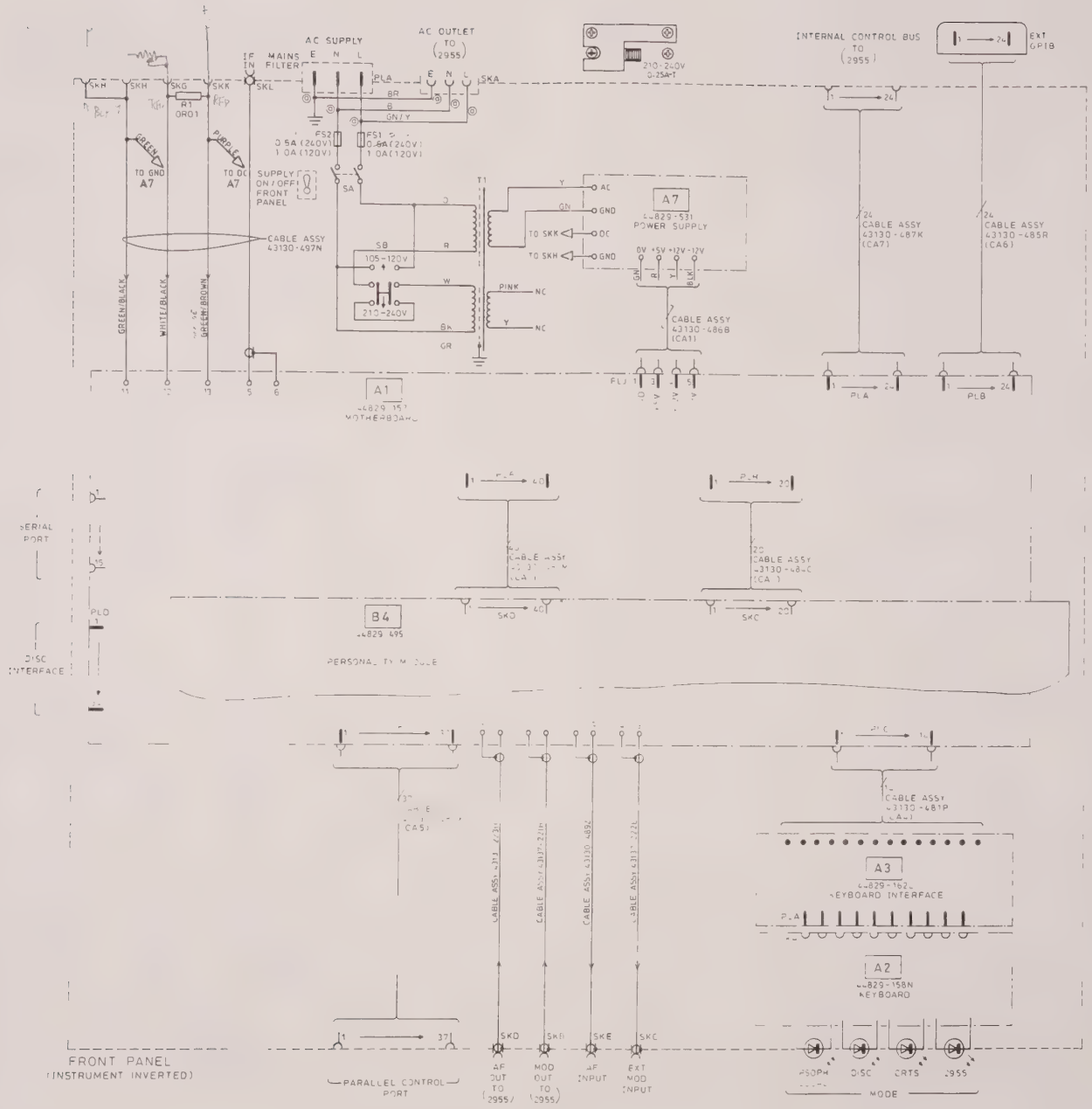
ICs DECOUPLED AT +12V TO GROUND AND -12V TO GROUND AS INDICATED

Drg. No. Z44829-157Y
Sht. 3 of 4, Iss. 2

A1 : Motherboard (interfaces)

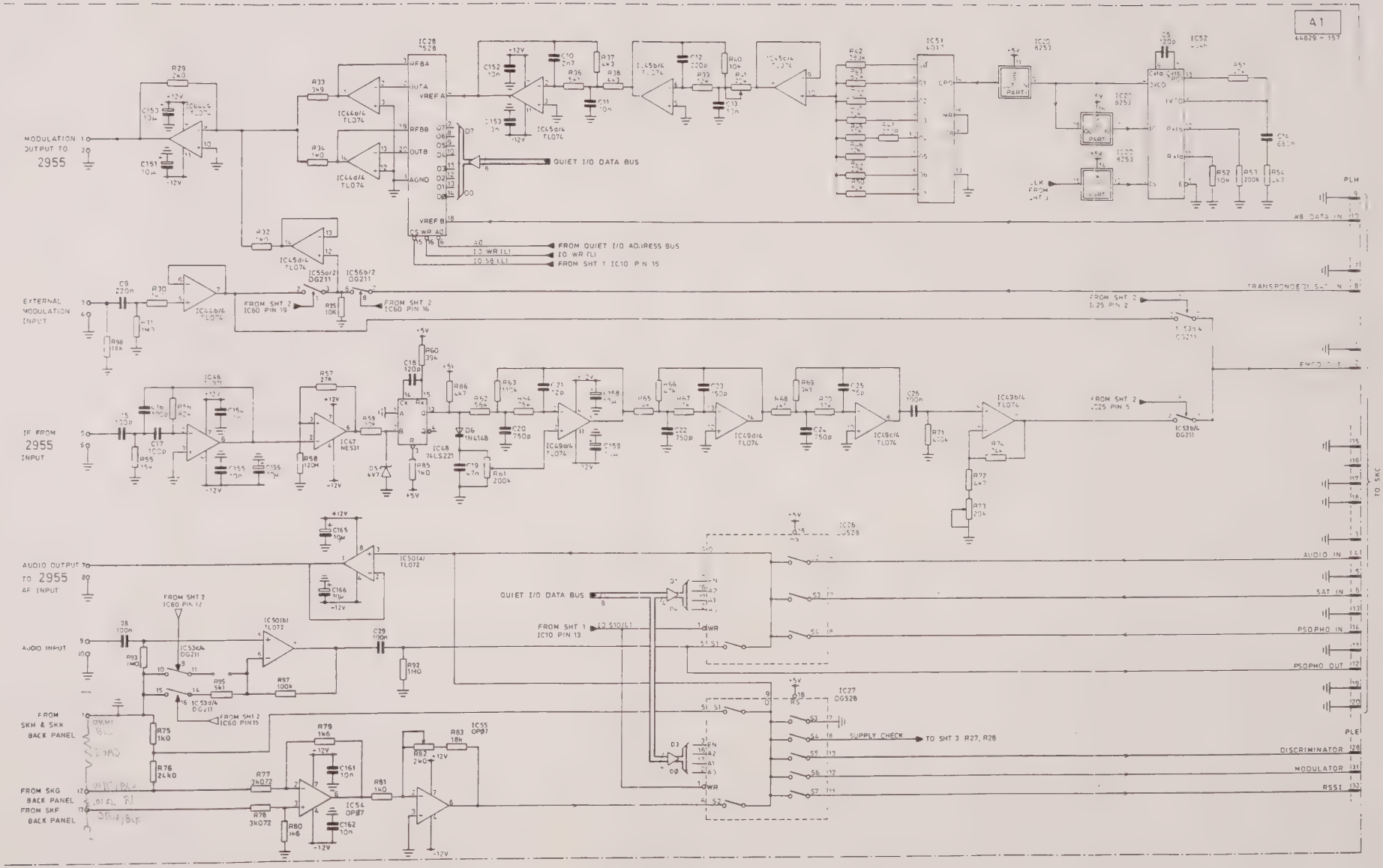


A1 : Component layout



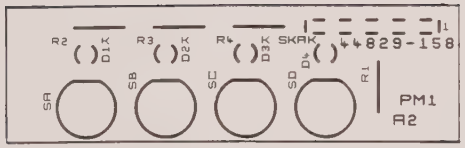
Drg. No. Z 54415-005E
Sht. 1 of 1, Iss. 1

A0 : Overall assembly

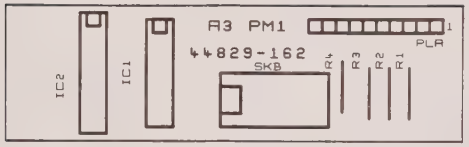


Drg. No. Z44829-157Y
Sht. 4 of 4, Iss. 6

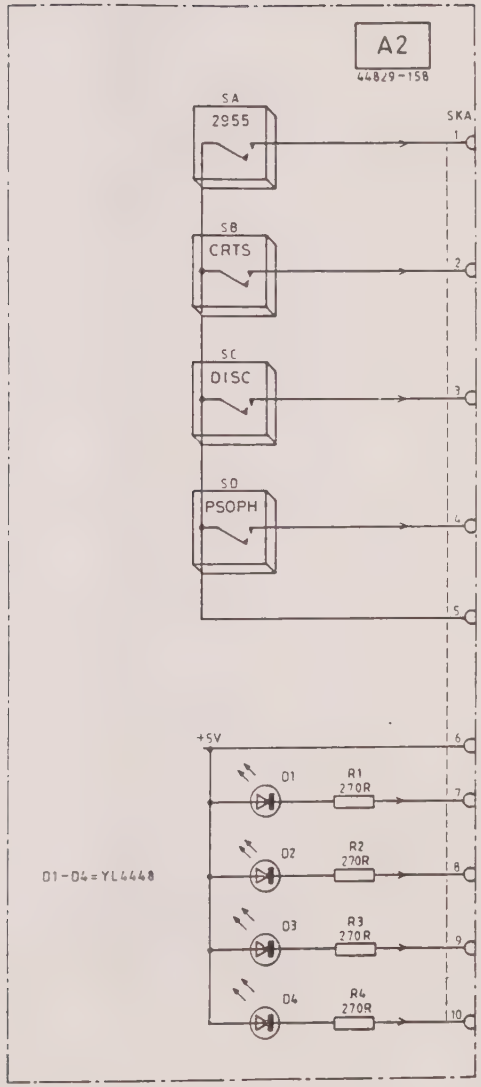
A1 : Motherboard (analogue)



A2 : Component layout

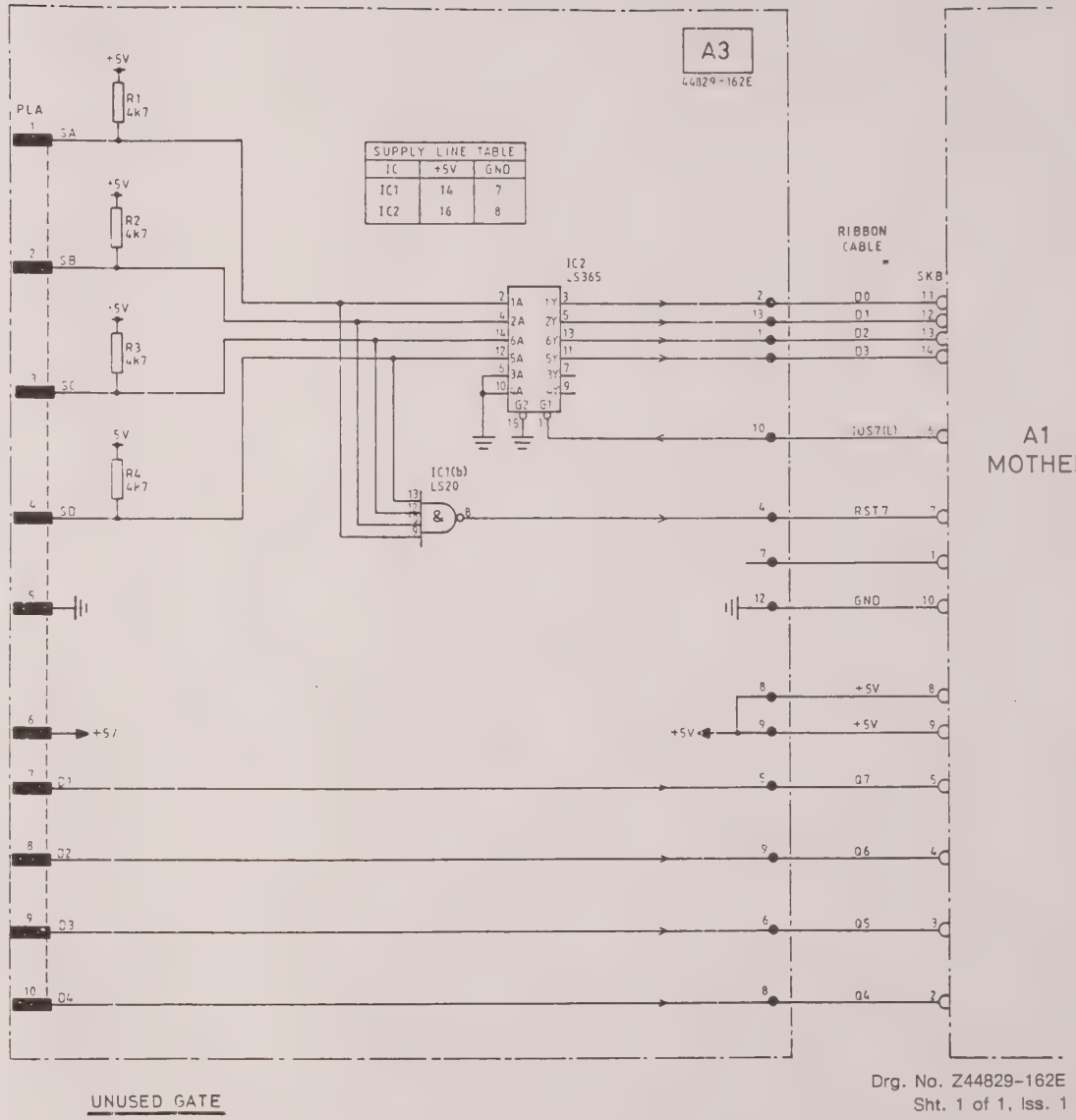


A3 : Component layout



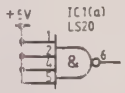
Drg. No. Z44829-158N
Sht. 1 of 1, Iss. 1

A2 : Keyboard

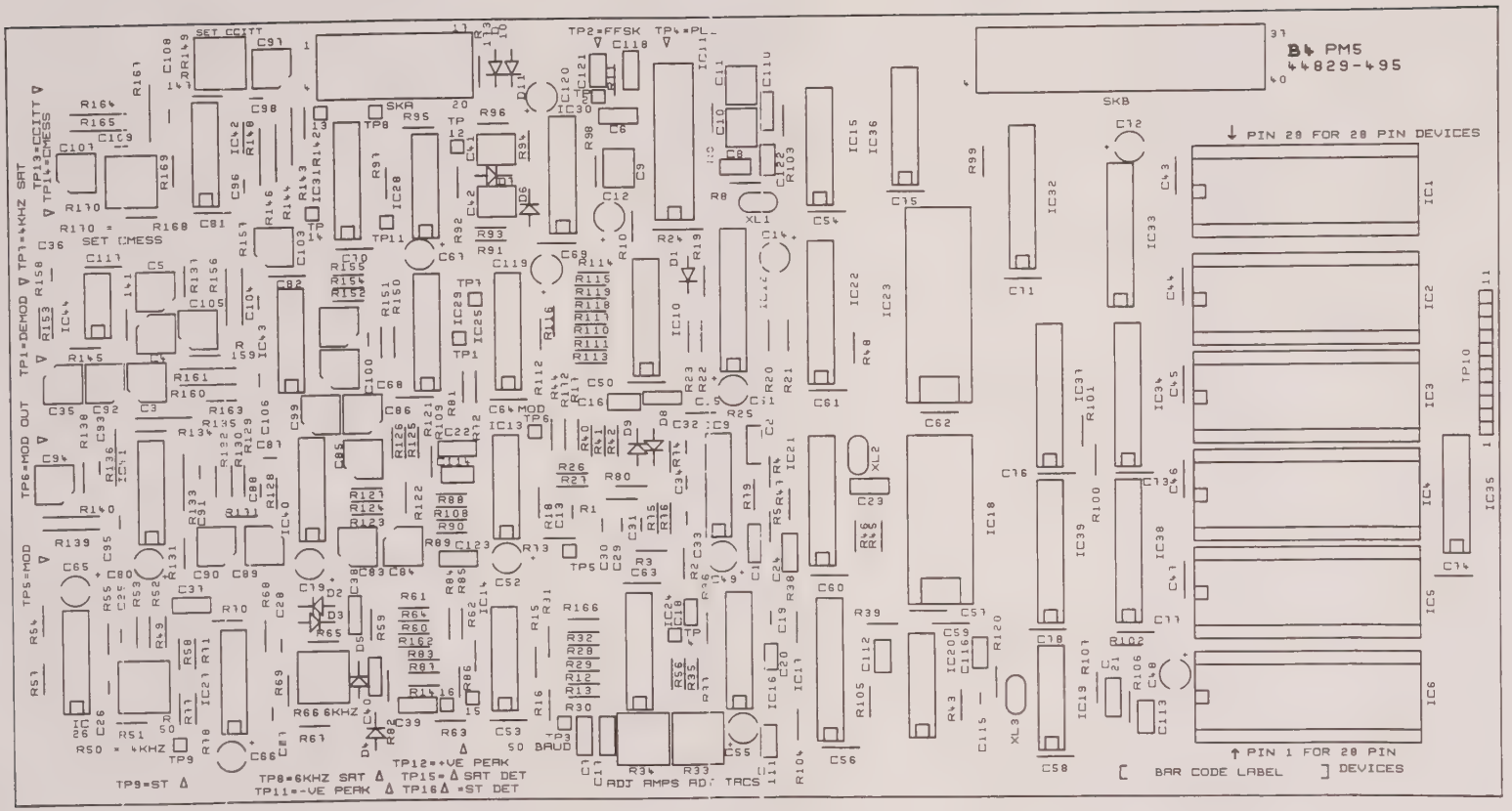


Drg. No. Z44829-162E
Sht. 1 of 1, Iss. 1

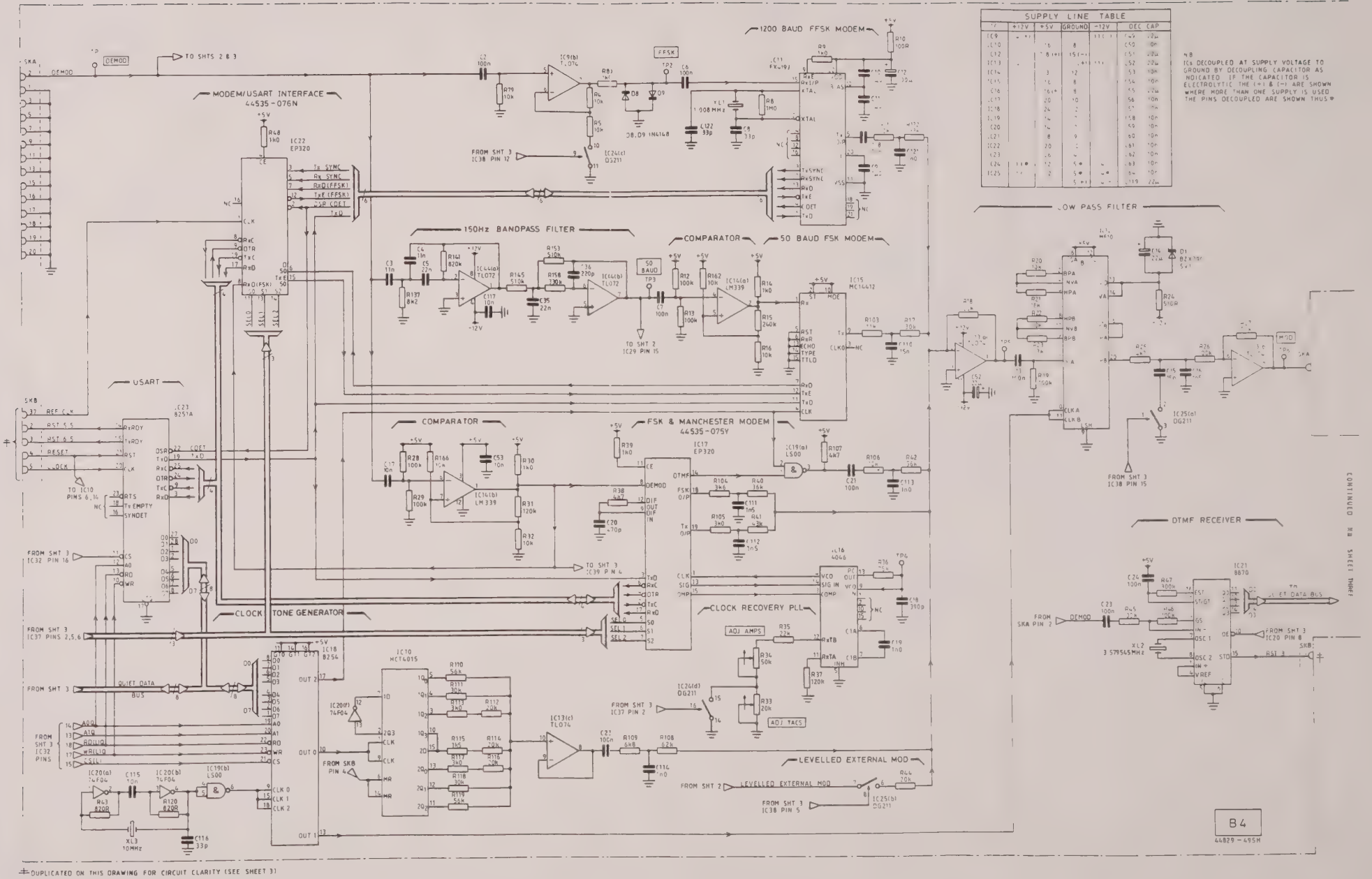
UNUSED GATE



A3 : Keyboard interface board

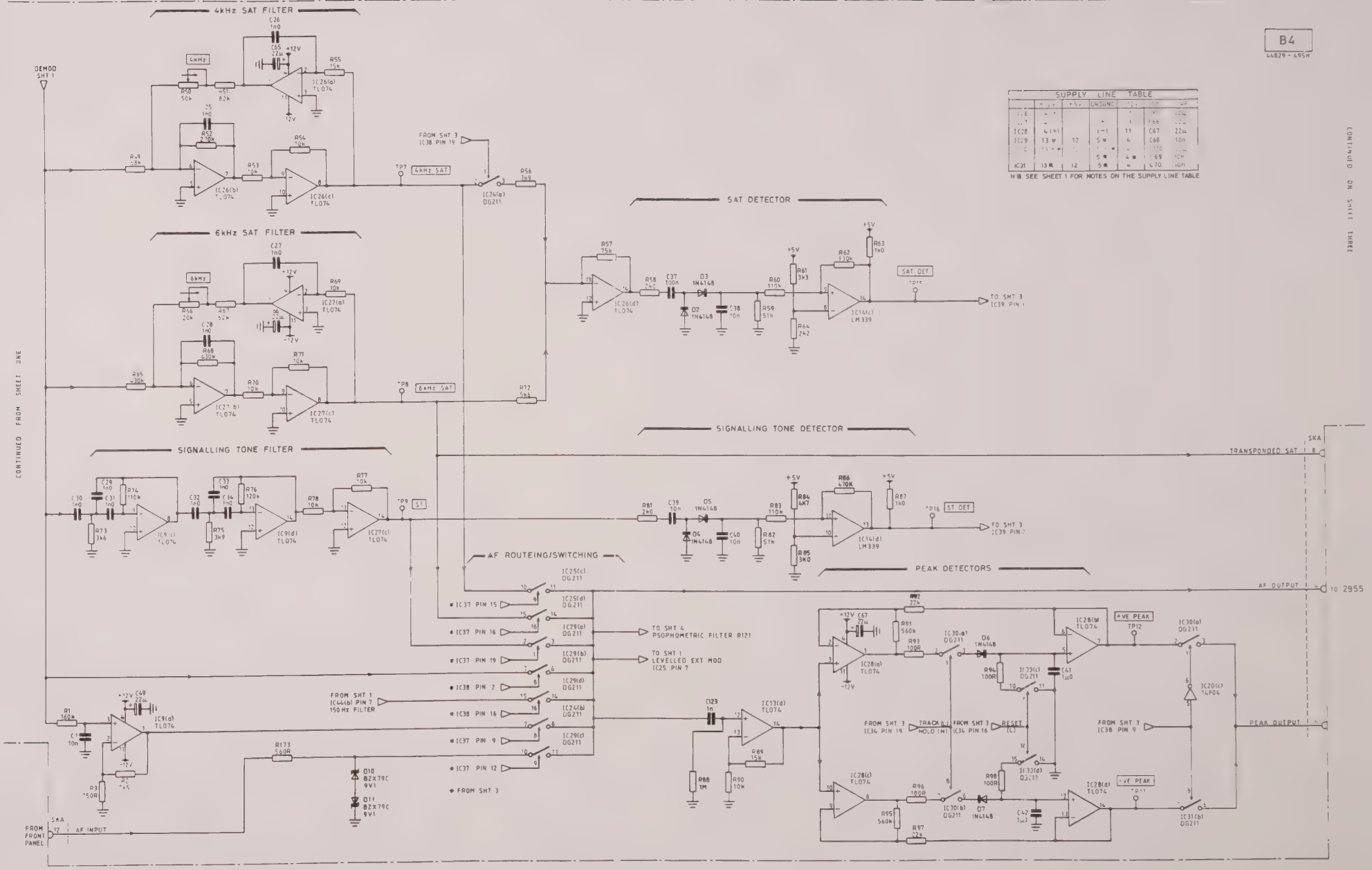


B4 : Component layout



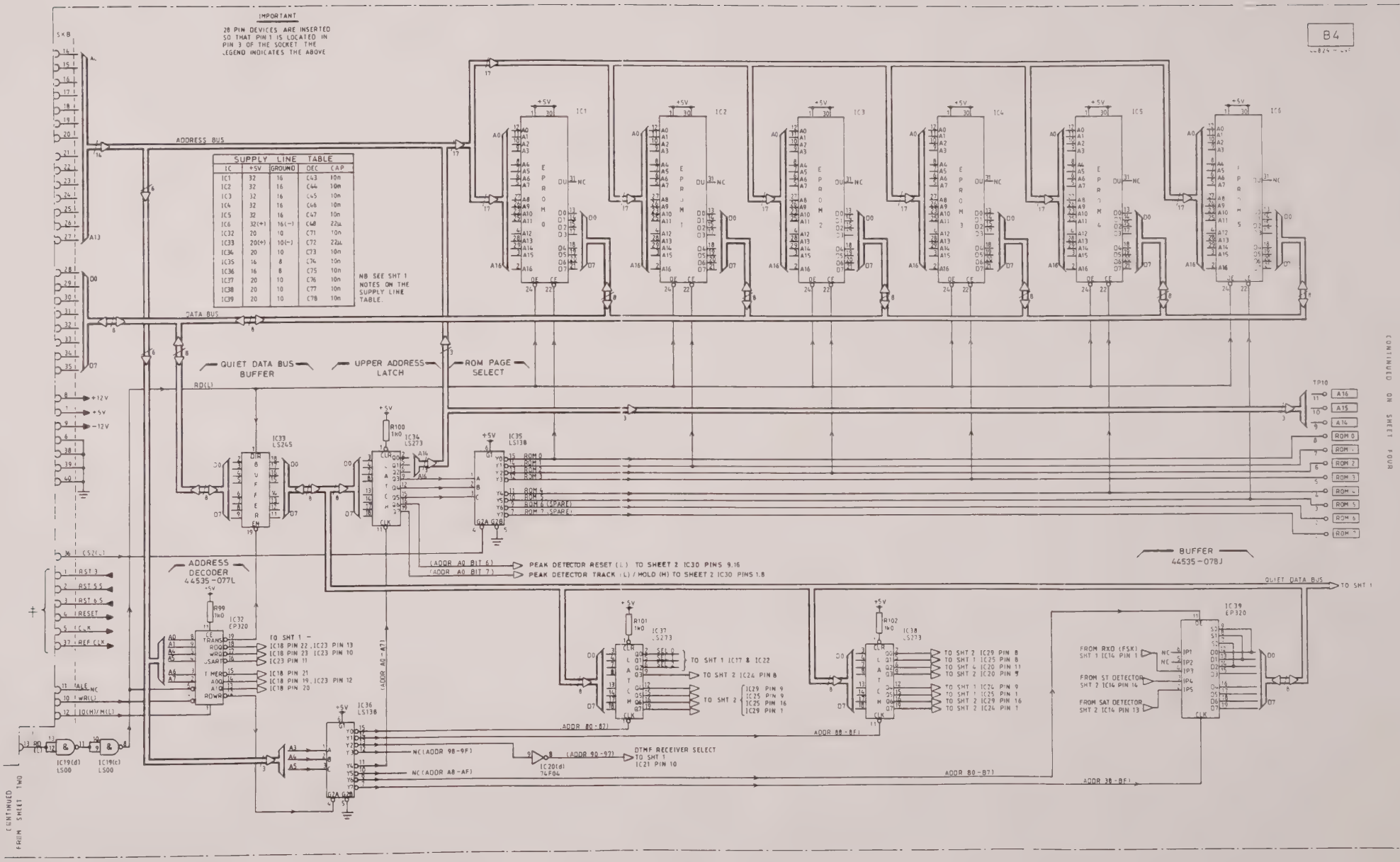
Drg. No. Z44829-495H
Sht. 1 of 4, Iss. 4

B4 : Personality board (modems)



Drg. No. Z44829-495H
Sht. 2 of 4, Iss. 4

B4 : Personality board (analogue)

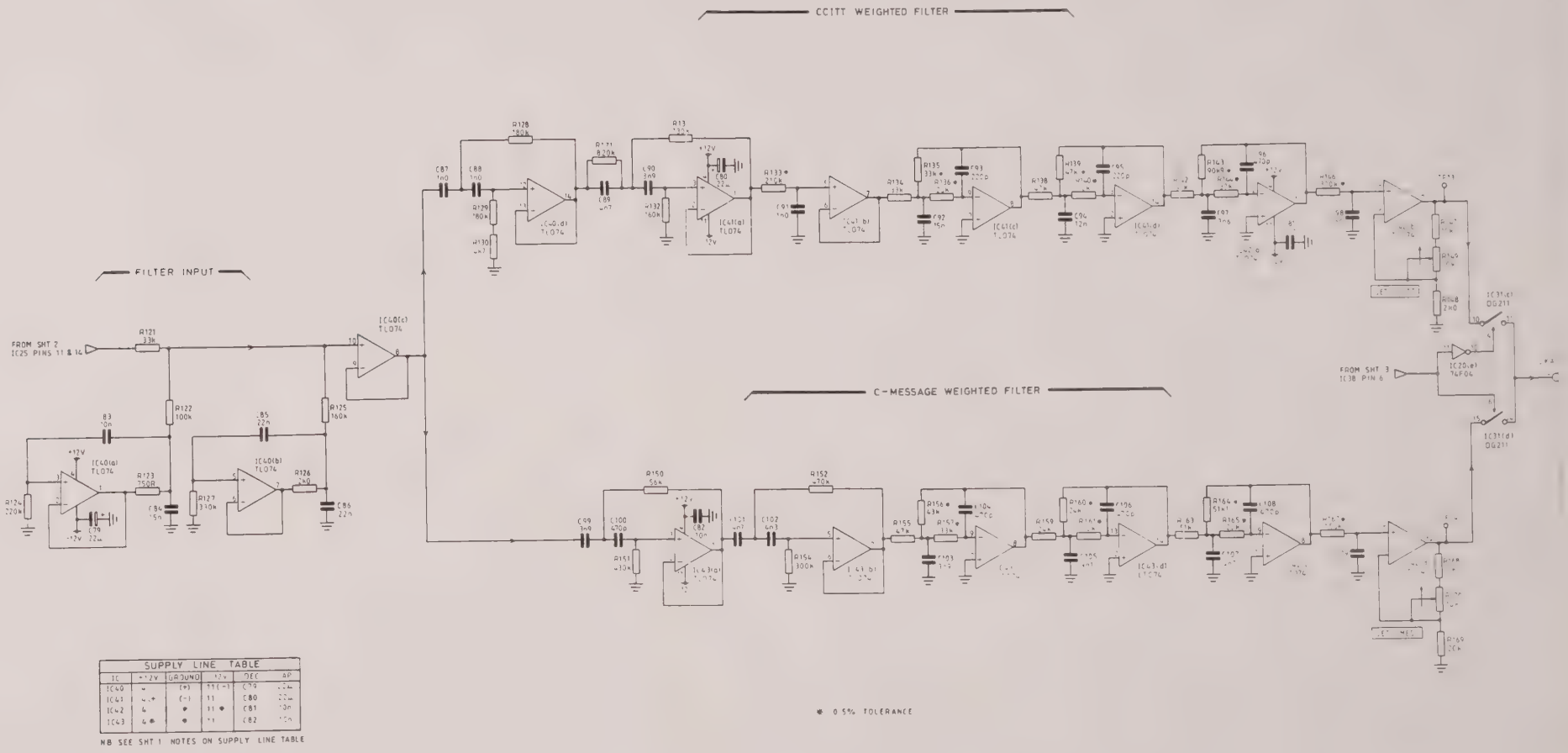

B4
IMPORTANT
28 PIN DEVICES ARE INSERTED SO THAT PIN 1 IS LOCATED IN PIN 3 OF THE SOCKET. THE LEGEND INDICATES THE ABOVE
SUPPLY LINE TABLE
IC | +5V | GROUND | DEC | CAP
IC1 | 32 | 16 | C43 | 10n
IC2 | 32 | 16 | C44 | 10n
IC3 | 32 | 16 | C45 | 10n
IC4 | 32 | 16 | C46 | 10n
IC5 | 32 | 16 | C47 | 10n
IC6 | 32(+) | 16(-) | C48 | 22µ
IC32 | 20 | 10 | C71 | 10n
IC33 | 20(+) | 10(-) | C72 | 22µ
IC34 | 20 | 10 | C73 | 10n
IC35 | 16 | 8 | C74 | 10n
IC36 | 16 | 8 | C75 | 10n
IC37 | 20 | 10 | C76 | 10n
IC38 | 20 | 10 | C77 | 10n
IC39 | 20 | 10 | C78 | 10n
NB SEE SHT 1 NOTES ON THE SUPPLY LINE TABLE.
ADDRESS BUS
DATA BUS
QUIET DATA BUS BUFFER
UPPER ADDRESS LATCH
ROM PAGE SELECT
ADDRESS DECODER 44535-077L
BUFFER 44535-078J
IC33 LS245
IC34 LS273
IC35 LS138
IC36 LS138
IC37 LS273
IC38 LS273
IC39 EP320
IC32 EP320
R99 1kΩ
R100 1kΩ
R101 1kΩ
R102 1kΩ
IC19(d) LS00
IC19(c) LS00
IC20(d) 74F04
TO SHT 1 - IC18 PIN 22, IC23 PIN 13
IC18 PIN 23 IC23 PIN 10
IC23 PIN 11
IC18 PIN 21
IC18 PIN 19, IC23 PIN 12
IC18 PIN 20
(ADDR A0 BIT 6) PEAK DETECTOR RESET (L) TO SHEET 2 IC30 PINS 9,16
(ADDR A0 BIT 7) PEAK DETECTOR TRACK (L) / HOLD (H) TO SHEET 2 IC30 PINS 1,8
TO SHT 1 IC17 & IC22
TO SHT 2 IC24 PIN 8
TO SHT 2 IC29 PIN 9, IC25 PIN 9, IC25 PIN 16, IC29 PIN 1
TO SHT 2 IC29 PIN 8
TO SHT 2 IC25 PIN 8
TO SHT 4 IC20 PIN 11
TO SHT 2 IC20 PIN 9
TO SHT 1 IC24 PIN 9
TO SHT 1 IC25 PIN 1
TO SHT 2 IC29 PIN 16
TO SHT 2 IC24 PIN 1
FROM RXD (FSK) SHT 1 IC14 PIN 1
FROM ST DETECTOR SHT 2 IC14 PIN 14
FROM SAT DETECTOR SHT 2 IC14 PIN 13
NC (ADDR 98-9F)
NC (ADDR A8-AF)
(ADDR 90-97) DTMF RECEIVER SELECT TO SHT 1 IC21 PIN 10
ADDR B0-B7
ADDR B8-BF
CONTINUED FROM SHEET TWO
CONTINUED ON SHEET FOUR
‡ DUPLICATED ON THIS DRAWING FOR CIRCUIT CLARITY

Drg. No. Z44829-495H
Sht. 3 of 4, Iss. 2

B4 : Personality board (digital)

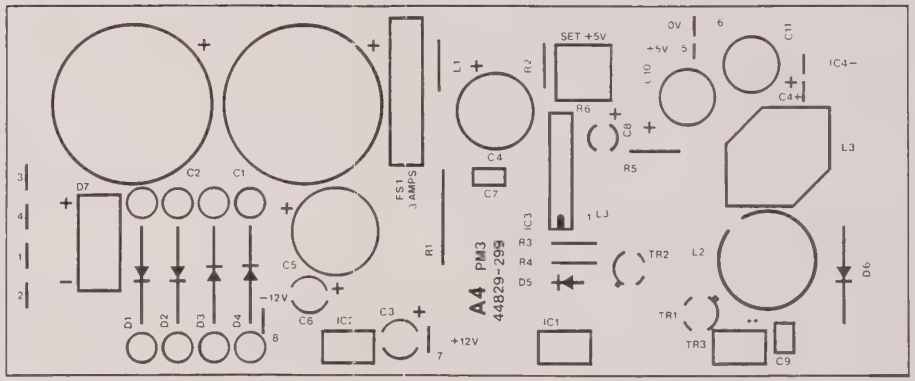
Fig. 9

July 89

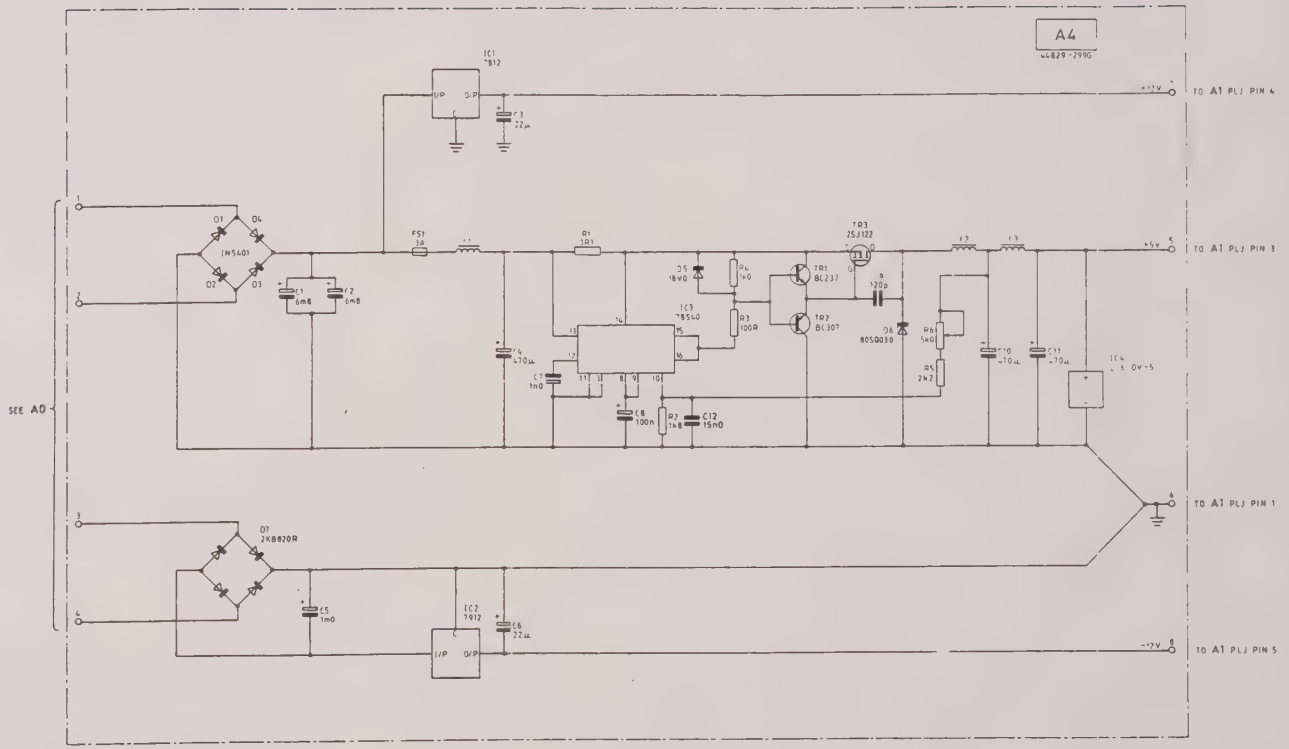


SUPPLY LINE TABLE					
IC	+12V	GROUND	-12V	DEC	AP
IC40	4	(+)	11(-)	C79	22u
IC41	4,8	(-)	11	C80	22u
IC42	4	•	11 •	C81	10n
IC43	4 •	•	11	C82	10n

NB SEE SHT 1 NOTES ON SUPPLY LINE TABLE

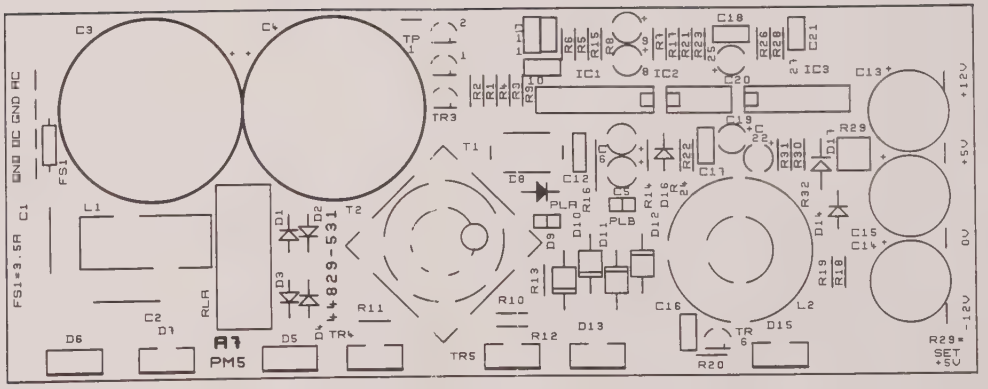


A4 : Component layout

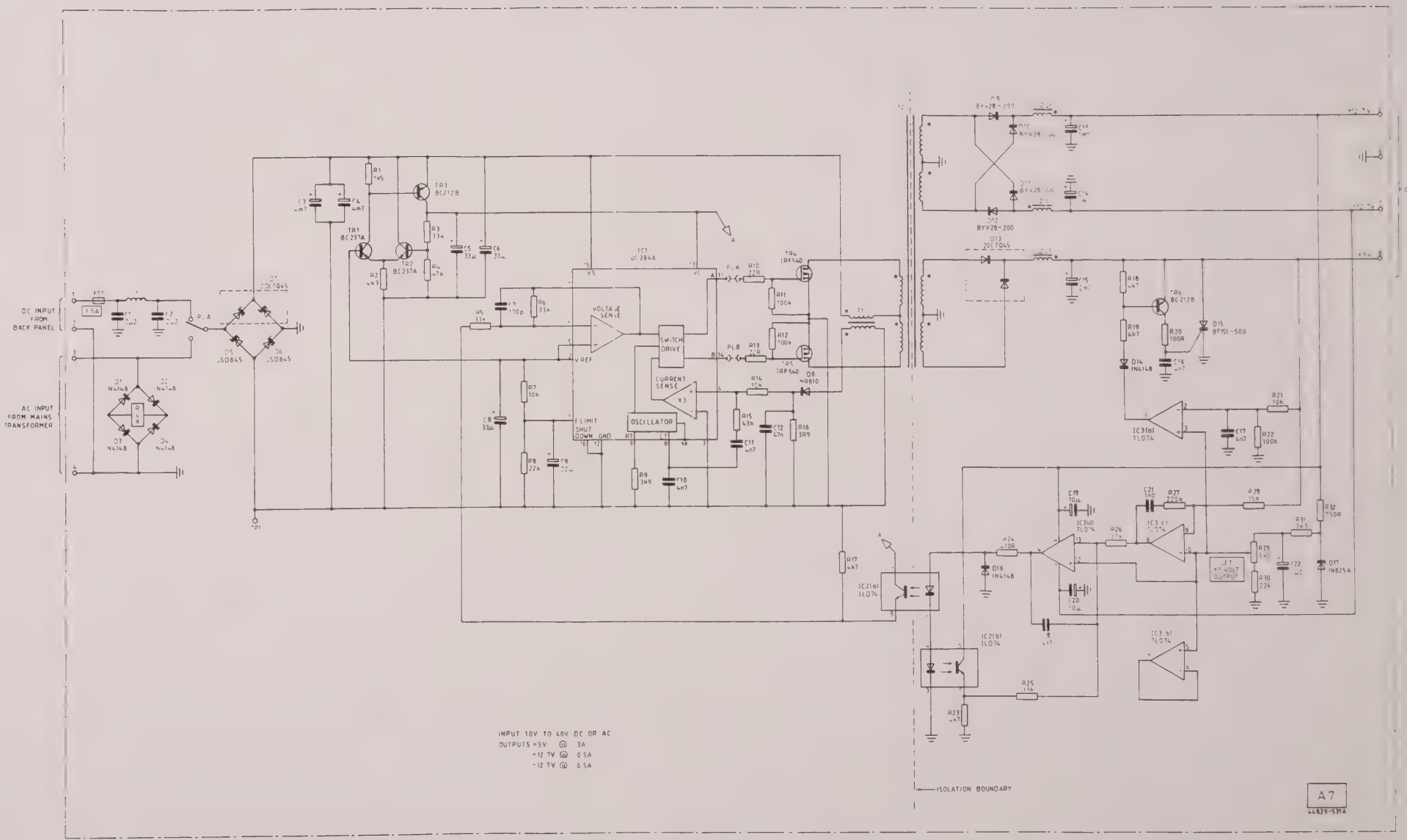


Drg. No. Z44829-299G
Sht. 1 of 1, Iss. 2

A4 : AC power supply board



A7 : Component layout



Drg. No. Z44829-531A
Sht. 1 of 1, Iss. 3

A7 : AC/DC power supply board

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